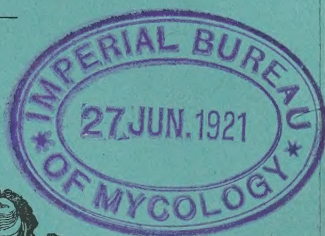


DEPARTMENT OF AGRICULTURE
BRITISH EAST AFRICA.



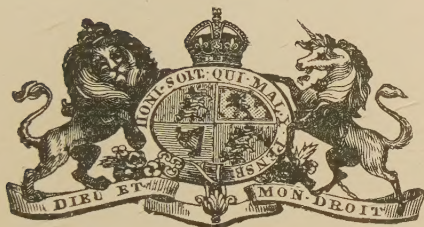
ANNUAL REPORT.
1913-1914.

NAIROBI.

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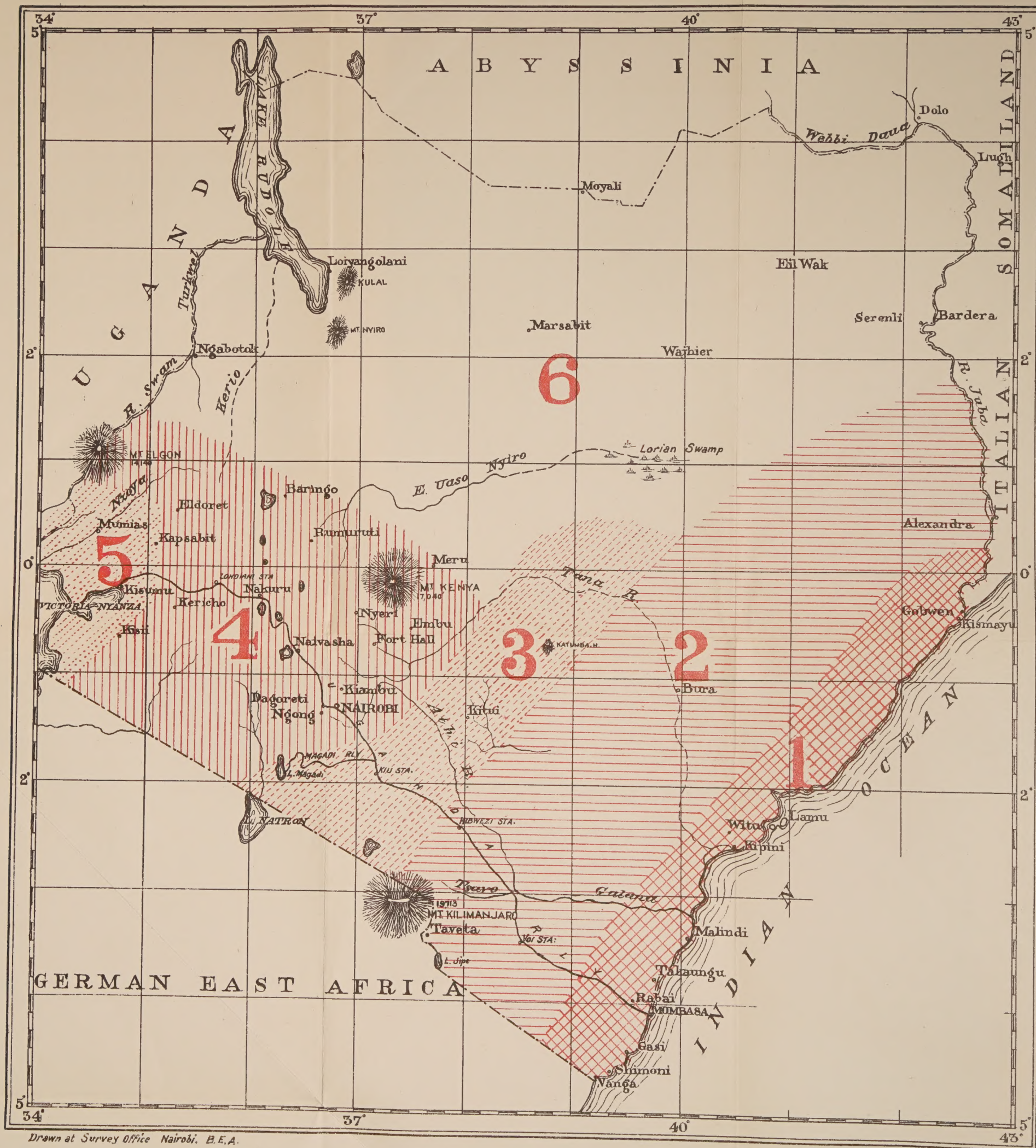
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EAST AFRICA PROTECTORATE



Drawn at Survey Office Nairobi. B.E.A.

Scale 54 Miles = 1 Inch

100 50 0 100 200 Miles

ANNUAL REPORT

ON THE

AGRICULTURAL DEPARTMENT,

FOR THE YEAR

1913-1914.

DEPARTMENT OF AGRICULTURE,
NAIROBI, BRITISH EAST AFRICA,

AUGUST, 1914.

HIS EXCELLENCY THE GOVERNOR,
Nairobi.

YOUR EXCELLENCY,

I have the honour to submit herewith my report of the Agricultural Department for the year ending the 31st of March, 1914, together with the reports of the Chiefs of the various divisions of the Department.

GENERAL.

The year can be characterised as one of conspicuous development in nearly all branches of farming.

The prosperity of the Protectorate depends mainly on its agricultural resources, agriculture being the chief, if not the only, industry of any importance.

Its resources have now been developed to that extent that it seems desirable at this stage to (a) review its progress from the beginning of the past eight years, the date when the Protectorate began to be considered a practical proposition for settlement, and (b) to remark on the future possibilities and on the future development of its natural resources and potentialities, in other words to consider the Protectorate's undeveloped wealth.

The majority of our pioneer settlers took up land in and around the Nairobi district, and in the absence of data, their early attempts at agriculture seem to have been almost entirely of an experimental nature, resulting in many instances in costly individual trials.

Facilities for transport, the marketing of produce and supply of labour, were in the early days far from what could have been desired, and for the first few years the lot of the average settler was not a particularly happy one. It is, however, pleasing to note that the majority, having weathered the storm, as it were, are now reaping the reward of their past efforts, and their outlook may be regarded as one of good promise.

The Life Zones of the Protectorate have not yet been accurately defined or mapped out, for the peculiarly diversified surface, and the varied climatic conditions and resources, render the country a very difficult field for survey. But roughly speaking the Protectorate can be divided into six zones, *e.g.*

1. The Coast or Lowland zone.
2. The Midland zone.
- The Upland zone.
4. The Highland zone.
5. The Lake zone.
6. The Semi-Arid zone.

1. The Coast Zone comprises a belt of land 40 to 50 miles in width, running from Vanga, on the German East border, to the Juba River. Climatically it may be considered to be purely tropical, with an average of 35 to 40 inches. The cultivation of coconuts has been in the past the main industry, but although the export of copra has increased year by year during the past seven years, the development of this rich tract has been very slow. This has been mainly due to the difficulties arising in connection with tribal claims, and our consequent inability to grant clear titles to planters and companies wishing to exploit unclaimed land.

Besides coconuts, in late years other crops, such as sisal, rubber, cotton, rice, maize, beans, sugar cane, etc., have been proved, and when the land titles are settled the Coast belt should offer an excellent field for investment.

2. The Midland Zone lies westwards, and approximately parallel to the Coast Zone. It represents a belt about 130 to 150 miles in width, covered in the main with scrub and bush. What is known as the Tana Desert and the Seringetti Plain, together with the Voi and Kibwezi districts, are included in this area. The Tana Desert and the Seringetti Plain are for the greater part of the year waterless, but the land is rich, and a large area of the former, under a comprehensive scheme of irrigation, could be made a very valuable agricultural proposition for the cultivation of sisal, rubber, maize, and other crops.

In the Voi and Kibwezi districts the rainfall is heavier, and is spread over a longer period, in consequence of which the bush and scrub are somewhat denser in growth. Conspicuous amongst the vegetation are the Baobab (*Adansonia digitata*), the flat-topped *Accacia* (*Accacia subulata*), and numerous varieties of *Sanservieria*, *S. Zeylanica*, *S. Cylindrica*, etc., some of which are being exploited for their fibre. In certain areas, after the removal of the *Sanservieria* and the clearing of the land of bush,

sisal and rubber as dry land crops have been planted out with satisfactory results. These two districts of Voi and Kibwezi offer a large field for the extensive development of the fibre and rubber industries, and around Kibwezi, where land has been put under irrigation, tobacco, coffee and citrus cultivation are also promising industries. But until the available land in the Highland Zone, with its more congenial climate, is occupied, development to any extent is not anticipated.

On account of the tsetse fly over a large area of the Midland Zone, stock farming cannot be pursued.

3. The Upland Zone comprises an extensive open plain to the west of the Midland belt, running from the German border near Magadi to a little beyond the Tana River. It has an altitude of between 4,000 and 5,000 feet, with a somewhat uncertain rainfall of from 15 to 38 inches. Maize and beans are grown in certain areas, and on some portions of the Athi and Kapiti Plains sisal is promising well, but generally speaking the zone is more adapted for stock raising than for agriculture, the short rich grasses offering excellent pasturage.

4. The Highland Zone includes the Nairobi, Kikuyu, Kyambu, Kenia, Naivasha, Nakuru, Lumbwa, Kericho, Kisii, and Uasin Gishu districts, and is the most promising area of the Protectorate for white settlement. In the eastern half of the zone the soil is a rich chocolate loam, highly ferruginous; in the Rift Valley it is lava ash; and from the Mau Range westwards a grey sandy loam exists, rich in humus. All three varieties are very fertile. The climate is cool and healthy, with an average minimum and maximum temperature of 50 and 70 degrees Fahrenheit respectively, and a certain average rainfall of about 40 inches. The altitude of the occupied area ranges from 5,000 feet at Nairobi to 9,000 feet at Londiani and the entrance of the Uasin Gishu plateau. On the upper elevations are to be found dense forests of many varieties of trees, chief of which are the Yellow Wood (*Podocarpus milangiana* and *P. gracilior*), the East African Cedar (*Junipirus procera*), the Olive (*Olea chrysophylla* and *O. hochstetteri*) and the Camphor tree (*Ocotea usambarensis*). On the lower altitudes are to be found a large variety of tropical, semi-tropical, and temperate zone crops. The chief products are coffee, wattle bark, potatoes, maize, beans, wheat, and sisal fibre, and data is now available indicating that the cultivation of sugar cane, citrus and flax compares favourably with that of other countries in which such crops are a special feature. It is not so much a question of what crops can be successfully raised in this zone, but which are the most profitable to grow.

Further, the Highlands sustain a very large number of cattle and sheep, and it has been now proved that both pure bred sheep and cattle thrive equally well as they do in countries from which they have been imported.

5. The Lake Zone.—Beyond the western boundary of the Highland Zone the country suddenly drops in altitude to between 4,000 and 4,500 feet, the climate being warm and humid, and the vegetation of a decidedly tropical nature. The soil of the greater part of this belt is what is commonly known as Cotton soil, and is capable of producing very heavy crops.

During recent years very extensive agricultural development has taken place over this Lake Zone, the chief products being maize, beans, sorghum (mtama), sim sim, cotton, ground nuts, sugar cane, bananas, and rice. Other crops, such as coffee, tobacco, chillies, fruits, potatoes, and other vegetables are also raised, and on one estate sisal has proved a profitable industry. Cattle thrive and do well in most parts of the belt, and large quantities of ghee are produced and disposed of by the natives.

6. The Semi Arid Zone.—To the north of the Zones already referred to lies a very large tract of country (in extent about one half of the Protectorate), occupied in parts only by various pastoral tribes of natives. Along the banks of the Juba River an area can, and no doubt at a later date will, be put under irrigation for cotton cultivation. Generally speaking, this zone may be considered as a semi arid region, much of which is waste land. The better portions, however, are utilised for the raising of the hardy native zebu and hairy sheep.

In the first five zones referred to it is estimated that forest reserves comprise an aggregate area of 2,100,000 acres, while 4,383,500 acres have been alienated for white settlement, chiefly in the Highland Zone. In the early days of settlement purely agricultural land was allotted in areas averaging 475 acres, while the average size of mixed farming and pastoral farms were 3,000 and 5,000 acres respectively. In the later surveys the areas of the farms were considerably reduced, most of them being considered suitable for mixed farming. There is now a wide and varied selection of land surveyed, which it is proposed to auction at an early date; and the surveying of further land is being proceeded with.

It is stated in my annual report for 1912-13 that the feature of that year was the subdivision and sale of portions of many of the larger estates, creating a number of smaller farms. This has been continued during the year under review, and is likely to continue, as much of the land alienated is now proved to be suitable for intensive cultivation.

Transport facilities are rapidly improving, and when the construction of the tributary railways, now under contemplation, is finished, large tracts of land now in pasture can be brought under cultivation.

It is obvious, therefore, that there are opportunities and inducements offering for a large number of prospective settlers, and for the maintenance of a numerous white population in British East Africa.

CATTLE.

The Live Stock Industry.—The original, or native cattle, in the Protectorate belong to the Zebu, or Indian race of bovine species, of which we have several types, but probably the most valuable are those found in the Nandi, Lumbwa, and Lake districts.

In 1909 it was estimated that there were 750,000 head of cattle in the administrated area of the Protectorate; while in 1913-14 the approximate number is 780,000 to 1,000,000. The increase has been exceedingly small, due to a heavy mortality in the native reserves within the last three years from East Coast Fever and Rinderpest. The latter has been particularly deadly owing to the impossibility of controlling the movement of cattle within these reserves during the various outbreaks, and further, no serum was available at the time for conferring immunity.

With the settlers' herds, on the other hand, it was possible to control the disease. The outbreaks have been few, and the losses formed but a very small percentage of the total stock in their possession. The main feature in regard to the cattle is the improvement which has taken place through grading up with imported bulls, and with pure bred bulls bred in the country from established herds.

The native cattle have been found to be very susceptible to improvement; the first, second, and third crosses are far in excess in quality of any expectations, and while there has been no sign of loss in constitutional vigour, the gain in early maturity and in milk quality is very material. In the early days there were heavy losses among the imported bulls due to Red-water or Texas Fever, and many settlers were discouraged from risking further importations.

It was felt that it was the duty of the Government to establish pure bred herds for the supply of young bulls on Red water farms. In 1908 action towards this end was taken by the Government, and a number of cows, heifers and bulls of the Shorthorn, Ayrshire, Herefords and Friesland breeds were imported, and each year since further importations were made, including Red Polls.

The stock were artificialy immunised to Red-water Fever prior to leaving England, and the death rate on the Naivasha Farm has been comparatively small. The herd on March 31st last numbered 126 pure bred cattle, while bulls to the number of 71 have been sold to settlers at the annual sales.

A few settlers have also established small pure-bred herds, and now that it has been proved that by systematic dipping the risk of mortality from Red-water and East Coast Fevers is practically nil, and, further, that Rinderpest is under control, it is anticipated that importations of pure-bred stock for grading purposes, and for the establishment of further pure-bred herds, will increase largely.

The view is held by certain of our settlers, mainly those who come from the South African Union and Rhodesia, that to establish pure-bred herds or to grade up our native cattle beyond a certain point will prove a mistake, *i.e.*, to attempt to breed animals above the quality of the pasture land is sure to end in disaster. This view would probably hold good in our Semi Arid Zone, but not so in the Uplands, the Highlands, or in the Lake Zones of the Protectorate, where droughts and shortage of grass feed are unknown. In fact it has been proved that owing to the luxuriance of our pasture all the year round there is a tendency of the progeny of the imported milking breeds, such as the Ayrshire and Friesland, to run somewhat to beef, at the expense of their known milking qualities.

This brings us to the question as to whether our aim should be to strive for an export beef trade, or the development of a butter trade. In the opinion of the writer the country will never be a ranching proposition. Stock ranching can only be pursued profitably where extensive areas are available for large mobs of cattle which can run at large, with a few white overseers to supervise. Further, all land in the Protectorate, with the exception of the Semi Arid Zone and those parts in the Coast and Midland Zones in which tsetse fly is present, is suited for mixed farming, and therefore too valuable for stock raising for beef only.

Dairying has not made any very marked development as yet, the reason being that the native cattle are not good milkers, and that the number of grade cattle is still small. But as has been stated in previous reports, the conditions obtaining in the Protectorate are very favourable for the development of this industry, as the pasture remains green and succulent all the year round, and any supplementary food which may be required to maintain a steady and full flow of milk can be purchased at very low prices as compared with those ruling in European countries. Further, the climate is extraordinarily favourable, and the cool mornings are almost ideal for the manufacture of the various dairy products. The creamery which has been established at Lumbwa has proved a success, and others are likely to be established shortly.

Sheep.—The area of good sheep land in the Protectorate is much more restricted in extent than that for cattle grazing. But it is safe to say that the Rift Valley from Kijabe to beyond Elementeita, the Loita Plains and large areas of Laikipia, are adapted for woolled sheep, while large flocks of native sheep owned by native tribes living in parts of the Semi Arid Zone have been successfully raised for many years. It is not anticipated, however, that our settlers will become large sheep owners, as the conditions are not favourable for running large flocks, as is the case in Australia, the Argentine, and parts of South Africa. In these countries sheep can be run at large day and night at little supervision expense, and without much risk of thefts or

destruction by wild animals. Further, as stated in a previous report, most of the Crown lands alienated to settlers and suitable for sheep are also suitable for cattle raising, dairying or mixed agriculture, and that it is probable that a combination of these branches of farming will prove more profitable to pursue than specialising in sheep alone. In fact, it has been proved that for successful sheep farming a number of cattle is a necessity on the farm. The respective numbers are eight to ten cattle for each 100 sheep, the reason for this being that after the rains the grass becomes too rank and luxuriant for sheep, and requires grazing down by cattle in advance. Few of our settlers have had experience of sheep farming in other countries, and in consequence some have had to pay dearly at the outset for a knowledge since acquired regarding the treatment of sheep for wire and tapeworm. The mortality from these two diseases, among lambs especially, was exceedingly heavy, but by systematic dosing for these parasites the death rate has been considerably reduced. The following returns for the last seven years from the Government Stock Farm at Naivasha, and from a settler farming near Elementeita, go to show that under proper management the industry may be considered a sound and profitable one.

On the Government Farm on April 1st, 1907, the total number of sheep, including lambs and wethers, comprised 1,910 head.

In 1907-08	the purchases were	165	and sales	472.
In 1908-09	" " "	10	" "	1,205.
In 1909-10	" " "	Nil	" "	917.
In 1910-11	" " "	2	" "	1,102.
In 1911-12	" " "	7	" "	1,062.
In 1912-13	" " "	33	" "	787.
In 1913-14	" " "	4	" "	648.

Total purchases were	221	and sales	6,193.
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On March 31st, 1914, the sheep stock in hand numbered 2,225, as against 1,910 on April 1st, 1907, a difference of 315, making a total of 6,193 plus 315 equals 6,508

Less purchases	221
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Total increase for seven years	6,287
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On the 1st of April, 1907, the flock comprised:—

166 pure-bred sheep.

717 half-bred sheep.

77 three-quarter bred sheep.

950 native sheep.

Total	1,910
-------	-------

While on March 31st, 1914, there were on the farm:—

	761 pure-bred sheep.
	1,464 three-quarter, seven-eighths, and fifteen-
	— sixteenhs grade sheep.
Total	2,225

The farm was fully stocked with cattle, sheep and goats at the commencement of the period under review. Had there been extra grazing available a number of young breeding ewes which were sold in 1909 and 1910 might have been retained for further breeding, and a larger increase shown on March 31st, 1914; but the figures as they stand show very satisfactory results.

On the settler's farm at Elementeita already referred to the flock in March, 1907, numbered ... 3,349 head.

Purchases during the seven years were ... 450 „

Total ... 3,799 „

In March, 1914, the flock numbered ... 9,997 „

Sales during the seven years were ... 7,628 „

Total ... 17,625 „

Less ... 3,799 „

Increase during the seven years period ... 13,826 head.

These figures show even more satisfactory results than those given for the Government Farm, but, as mentioned above, the Government Farm was fully stocked in 1907, while in the case of the Hon. Galbraith Cole's farm extra grazing was available, and few or no ewes were disposed of until they had reached an age when further breeding from them was considered inadvisable.

Generally speaking, the robust woolled sheep of the Wangella type) have proved the most satisfactory, not only as pure bred flocks, but also for grading up the native ewes. The third and fourth cross from native ewes with large-framed, plain-bodied Merino rams have been found most profitable animals, both from the points of view of wool and meat. This type of sheep shears 6 lbs. to 8 lbs. of wool, for which 10d. to 10½d. per lb. has been realised in the London market, while a fat wether of the same class fetches from Rs. 10 to Rs. 12 in Nairobi.

It is pleasing to note that the native boys make excellent shearers. A gang of ten can shear as many as 500 sheep a day at a total cost of Rs. 15, as against Rs. 15 per 100 in Australia.

Pigs.—In the days of the first settlers there were brought into the Protectorate a number of swine from the Seychelle Islands, animals characterised by length of limb and nose, narrowness of back, slowness in maturing, and the production of indifferent bacon.

The first importations of high class stock were made in 1906 by Captain Grogan, Lord Delamere, and the Government. Further importations by other settlers followed at various times. In 1908 a bacon factory was established at Escarpment, but unfortunately at this time two factors militated against success. Firstly, the lack of practical knowledge of pig breeding on the part of the majority of the settlers; and secondly, the presence in the country of the inferior class of pig referred to above. Needless to say, the efforts made to produce a good bacon yielding animal from such a source were not successful, and the results were accentuated by the practice of treating the herds as grazing animals, with a minimum ration of maize or other artificial food. No domestic animal deteriorates so rapidly as the pig when allowed to revert to a state of nature.

Throughout this period, however, there were a number of farmers who started with high-class foundation stock, and have from the outset continued to breed it up, with the result that to-day they can show herds equal in quality to the average home pig. In fact the industry has been found to be a very paying proposition, giving quick returns.

One of our principal pig-raisers estimates his net profits to be from Rs. 10 to Rs. 15 for bacon pig (of, say, 200 lbs.) made out as follows:—

		Rs.	cts.
Bacon pig, 200 lbs. at Rs. 22 per cwt.	...	44	00
Feeding—15 loads maize at Rs. 1/20	... Rs. 18		
3 loads barley at Rs. 2	... Rs. 6		
Labour, general charges, etc.	... Rs. 5		
	—	29	00
Net profit	... Rs. 15	00	

The dairy industry is now developing, and pig raising may be considered as complementary thereto; while maize, barley, potatoes, rape, lucerne, etc., for fattening, can be grown at a low cost as compared with other pig raising countries.

Swine fever, which is supposed to be propagated and spread by the indigenous wild pig, is virulent, but by no means prevalent, no outbreaks having been reported during the past year. It has been proved that the disease is neither air-borne nor transmitted by external parasites, and the Chief Veterinary Officer is of opinion that there is very little risk of its introduction if the piggeries and paddocks are fenced with wire netting, placed some distance in the ground to prevent burrowings. Measles, which is so prevalent in South Africa, does not exist here.

At present the local demand for bacon far exceeds the supply, and this is likely to be the case for some time to come, owing to the rapidly increasing population, but there is a world-wide market for bacon when a surplus arises.

The favourite breeds are Berkshire, the Long Black, and the Tamworth, preference being given to the two former. The white Yorkshire has been given a trial, but has not proved satisfactory, its pink skin being readily scorched by the sun. A very large demand exists at present for breeding sows, and large numbers have been supplied from the Government Farm at Kabete, but further and large importations must be made to meet requirements.

Horses.—Previous to the construction of the Uganda Railway there were only a very few horses in the Protectorate, which were imported and taken to the Highlands under great difficulties, owing to the presence of tsetse fly in the Coast and Midland zones.

After the completion of the line through these two belts of country a number of Arabs and Country Breds were imported from India by Messrs. Jeevanjee and Co. Later, a small consignment was brought down from Aden, consisting of English, South African, and American horses sent from the South African Remount Depots to Somaliland during the campaign of 1903.

In 1905 the approximate number of horses in the Protectorate was between 80 and 90, but during that year a severe epidemic of horse sickness occurred, to which a large percentage of horses succumbed.

The result of this outbreak caused a temporary set-back to further importations of any importance. During 1906 and 1907, however, a few mares and geldings from India, England, South Africa, and Abyssinia were brought in from time to time, and it was found that when properly stabled at night the percentage of deaths from horse sickness was comparatively small.

The initiative was then taken by Government to establish a horse breeding industry by the importation of an Arab stallion, strongly built, with plenty of bone. This was shortly followed by further importations by settlers of Arab stallions and brood mares, the latter coming mostly from South Africa.

Up till three or four years ago practically all the country bred were sired by Arab stallions, and the mating, especially with common mares, proved very successful, the progeny being in most cases superior in quality and bone to the dams.

Latterly the tendency has been in favour of using thorough-breds as sires, of which there are now nine in the Protectorate.

Though horse breeding may be said to be fairly established, it is not likely that horse ranching will be pursued in any part of the Protectorate until a remedy for horse sickness is discovered. Till then horse breeding will be carried on as an accessory branch of farming, and the mares limited to the number that can be carefully tended and housed at night.

There is some difference of opinion among our settlers as to the type of animal to breed up to. Racing will always continue to be a pastime in the Protectorate, but the progeny of thoroughbred stock on both sides is now coming into the ring, and in a year or so grade horses will have little chance of winning on the racecourse, while with the advent of the motor-car the demand for big harness horses is certain to decrease.

On the other hand, there always will be a good market for the thick set pony of 14.2 hands, or just under, with dense bone, good constitution and endurance. A horse of this type is a handy size for riding on the farm, for safari work, for certain military requirements, for polo, and also for light harness work.

Ostriches.—The ostrich industry was dealt with at some length in my last annual report, and as there is but little change in the position to-day it is unnecessary to go into details again.

The slump in prices of feathers, and the importations of large consignments from South Africa for sale in the Kavirondo market, where hitherto a ready sale was found for our second quality feathers, has militated against any further development of this branch of farming during the past year.

CROPS AND ECONOMIC PRODUCTS.

Coffee.—The history of the rise in the coffee industry is a very interesting one. In 1901, seed of the variety known as Coffee arabica was imported from Bourbon by the St. Augustine Mission and planted out at their Kikuyu station. The trial proved satisfactory from the point of view of yield, and samples of coffee sent to France were very favourably reported upon. Subsequently a small consignment of Blue Mountain Coffee (*Coffea arabica* var *Costa Rica*) was imported.

From the above plantation seed was obtained by a number of settlers, and in 1907 the area under cultivation was estimated at between 500 and 600 acres, the largest plantation being that of Messrs. Felix and Favre's Ruaraka Estate, where 60 acres were in bearing at that date. From this time the success of the industry appeared to be assured in the Kikuyu and Kyambu districts, the light loamy soil, of great depth, highly ferruginous in nature and well drained, having proved to be eminently suitable not only for the production of heavy crops but also for berries of high quality. The estimated yield from five-year and over trees being 900 to 1,000 lbs. per acre, and the current rate of from £70 to £80 per ton.

The discovery in October, 1912, of the presence of leaf disease due to the rust fungus *Hemelia vastatrix* on two plantations created a temporary check to development. The results, however, of close inspection of these and other plantations which subsequently became infected indicate that the disease is not likely to have the same deleterious effect in the Protectorate as hitherto obtaining in other countries where the humidity is very much greater and the soil not so rich.

The disease is not now dreaded, for it has been proved in other countries that on good and well drained soil, and when the healthy development of the trees is maintained by systematic cultivation and suitable manuring, the parasite causes comparatively little damage.

So far no other serious fungus disease has appeared. *Black Blight* is not uncommon, but this is easily and effectively dealt with by spraying. Cut worms have proved troublesome in some of the young plantations, and especially on lands which have only been brought under cultivation shortly before being planted out. This pest, however, can be controlled to a certain degree by spreading green chopped grass or lucerne moistened with a solution of arsenic and sugar on the land.

The following is a statement of the value in rupees of the coffee exported during the last seven years, *e.g.* :—

1907-08, Rs. 4,031; 1908-09, Rs. 3,539; 1909-10, Rs. 16,012; 1910-11, Rs. 44,728; 1911-12, Rs. 85,571; 1912-13, Rs. 160,199; 1913-14, Rs. 275,585.

From these figures it will be seen that the value of the exports have doubled each year, and it is anticipated that for the next few years at least the exports will continue to increase in a like, if not in a greater, proportion, for during 1912, 1913, and 1914, large areas have been planted out, not only in the Kikuyu and Kyambu areas, but in the Lumbwa, Muhoroni, and Kericho districts, where the young plantations are exceedingly promising.

It was estimated that in March of this year, 5,000 to 5,500 acres were under coffee. There are still large areas of virgin land equally suitable for coffee cultivation as that which is now under cultivation; but the further development of the industry is dependent on the labour supply.

Hitherto a large proportion of the coffee has been exported in the husk, entailing a heavy expenditure in sea freights. It is hoped, however, that before another year elapses the husking machinery which the settlers contemplate erecting in Nairobi (to be run on co-operative lines) will be in working, thereby effecting a saving of freight on about 20 tons of parchment on the 100 tons as now exported.

It is hoped that grading machinery will also be erected by the company, to allow of shipments being sent direct to European markets according to the demands in such for certain grades.

In January last a Coffee Plant Inspector from Jamaica was appointed to advise planters in the various operations connected with coffee cultivation. The appointment has been a popular one, for many of our planters have had but little practical experience of the industry, and the advice of the Inspector has been, in consequence, much appreciated.

Sisal.—In 1902 and 1903 a number of sisal suckers were imported from German East Africa, and planted out in the grounds of Government House, Mombasa, and in the Provincial Commissioner's garden at Nairobi.

In 1904 trial plots were laid out by the Government at Nairobi, Makindu and Miritini, with bulbils obtained from German East Africa and St. Vincent. In 1905 rooted plants were issued from these stations to a number of the settlers in the Highlands, the Midlands, and the Coast belts. It soon became apparent from the results of the various trial plots that the plant would do well in each of the zones referred to, and the encouraging reports on samples of fibre sent at the latter date to the Imperial Institute, strengthened the view that a profitable fibre industry might be developed in the Protectorate. In the early part of 1907 large consignments of bulbils were imported from German East Africa by various settlers. In September of that year, however, a prohibitive duty was placed on all bulbils and suckers exported from that Protectorate, and closed this cheap source of supply. But the check to development was only temporary, for further supplies were obtained from India, and many thousands were imported from this source. Further, a number of the earlier introduced plants were by now poling—each plant producing from 2,000 to 4,000 bulbils—while many suckers were becoming available on the earlier established plantations. In 1909 the Department issued 129,000 bulbils and suckers from the various stations, and in 1910 a further 129,000 rooted plants.

In 1911 some millions of bulbils and suckers were available for the extension of existing plantations and the establishment of new ones.

The following table gives some interesting results of tests made at the Anglo-American Sansevieria Fibre Works at Voi in the decortication of sisal fibre grown at certain centres:—

Where grown.	Height above sealevel.	Age of leaves.	Number of leaves.	Weight of leaves.	Weight of leaves per 100.
	ft.	Y. M.		lbs.	lbs.
Near Fort Hall ...	4,500	3. 4.	232	566	243
Nairobi ...	5,450	4. 6.	250	706	282
Voi ...	1,830	3. 6.	300	557	185
Merihini ...	450	3. 4.	250	612	244
Mombasa ...	70	5. 6.	250	457	182

Where grown.	Average length of leaves.	Weight of dry beaten fibre.	Percent- age yield by weight.	Weight of beaten fibre per 100 leaves.
	ft. ins.	lbs.		lbs.
Near Fort Hall ...	3 8½	12	2.12	5.17
Nairobi ...	4 8	19.5	2.76	7.8
Voi ...	4 0	16	2.87	5.33
Merihini ...	4 9	18.5	3.02	7.4
Mombasa ...	5 2	20	4.39	8

Since these tests were conducted others have been made which support the results given in the table, *e.g.*, that on the Coast a larger percentage of fibre is obtained than in the Highlands, but it must be remembered that in the latter zone manual labour is cheaper, and oxen can be utilised for cultivation and draught purposes.

In 1912 the first decorticator, "The New Corona," was erected and at work. At present there are five decorticators in constant use, three "Corona's" and two of Robie's make, together with a few "Raspardors."

The total output now in the Protectorate is about 50 tons of fibre per week, which is realising £28 to £38 a ton in the London market.

More decorticators are being erected to cope with the increasing area which is reaching the harvesting stage, but this machinery must be considerably increased in a year or two in order to deal with the large area which has been placed under the crop during the last two years. It is estimated that there are some 7,500 acres planted out with sisal, while further large areas of virgin soil are now under cultivation for the extension of the industry, and it is anticipated that in the near future sisal fibre production will occupy a very important place among our agricultural interests.

In this Protectorate, and in German East Africa, sisal matures and poles at a much earlier period than in India, Australia, and Yucatan. This is probably due to our having two rainy seasons and two periods of growth in the year. This early maturity has its advantages, for whereas the yield of fibre from plants in a given area of land is much the same (three tons) in all sisal growing countries, these returns are obtained in the Protectorate in $5\frac{1}{2}$ to 6 years, as against 7, 8 and 12 years in India, Australia, and Yucatan respectively. Further, the quality of fibre due to the accelerated and almost continuous growth of the plants is equal, if not superior, to that of other countries in tensile properties, and this is shown in the difference of from £1 to £2 a ton in favour of the fibre produced in this Protectorate and German East Africa.

The reconstitution of the plantations has been a matter of much concern with our planters. It was at one time expected that after the final harvest the land would have to be cleared of the boles (30 tons or so per acre) and left fallow for a year or put under a rotation crop. Experiments, however, conducted by the Agricultural Department, have demonstrated the fact that after the second cutting of leaves suckers can be planted between the older plants, and that when the last cutting of leaves is completed the boles can be destroyed by the injection of a small quantity of arsenite of soda, without detriment to the suckers. From these suckers a first cutting of leaves can be obtained two years after the final cutting of the first established plantation. As a result of these experiments it is now found that a smaller area

can be worked economically as a sisal proposition. But even so, sisal cultivation is a branch of farming to be pursued by a company or by a person of capital rather than by a small holder.

From data obtained from various planters the following may be taken as a rough estimate of the capital expenditure in establishing a sisal plantation:—

Purchase of 1,200 acres	£2,400
(250 acres are required for grazing of working oxen)	
Planting with suckers and further tillage ...	£3,800
(Expenditure being spread over period of 6 years)	
Farm house and buildings ...	£800
Machinery and other plant, including engine, baling press, sheds and tram rails, etc. ...	£5,000
(Expenditure in the third year).	
Total ...	£12,000

A small revenue can be reckoned on in the first and second years from catch crops, but none from sisal until the beginning of the fourth year, from which date, at current prices for fibre, *viz.*, £28 to £30 a ton, or even at £25, a satisfactory balance sheet should be produced annually. At no period during the last 14 years has the price of sisal fibre fallen to £25 a ton, and there seems very little fear of the market being glutted for many years to come.

In Yucatan, the home of the plant, alcohol is now being profitably produced from the waste material, which at the end of the dry season contains considerable quantities of fermentable sugars. Efforts have been made to obtain the necessary yeast from Mexico, but so far without avail. The matter is now being taken up by the Mycologist and the Analyst to obtain a local yeast with a view to endeavour to ferment local sisal waste, but so far without appreciable success. A yeast isolated by the Mycologist from sisal plants grown in Nairobi fermented cane sugar solution, but not the juice expressed from sisal leaves, in which it would not live. On analysis this juice proved to be extremely acid, and contained less than 2 per cent. sugar. The experiments were made during the rainy season, when the sugar content of sisal juice is at its minimum. Analyses of the sugar content at the end of the dry season are not yet available, but those of the wet season, compared with Yucatan, are very low.

Cotton.—In 1904 a cotton expert from Egypt was appointed to conduct experiments at various parts in the Coastal zone to ascertain which were the most suitable varieties of cotton to grow, and, further, to encourage the natives to take up the industry. The results of the first two years' work were very encouraging, the seasons as regards rainfall being very favourable.

In 1906 it was arranged, in view of the interest shown by the British Cotton Growing Association in the development of the industry, and their preparedness to apportion a sum of money from their funds for such purpose, to transfer the Government

Experimental Cotton Farms for further experimental work, and to make an annual subsidy of £1,000 for three years, subject to the Association expending a sum of not less than this amount out of their funds. Experimental work was commenced in April by the Association, and a large ginnery erected at the principal station, *viz.*, Malindi. Albassi and Metaffi seed was imported in large quantities and issued free of charge to natives, and money was advanced to enable them to clear their lands, while advice was readily given in the growing of the crop. The outlook for the development of a large cotton industry appeared bright; so much so that a Company—the Sobaki Cotton and Rubber Company—also took the matter up, and a second ginnery was erected at Malindi. The years 1907-08 and 1908-09 were not propitious, the rainfalls being uncertain, and both harvests were far short of fair average crops, and in many instances the natives were not able to make good in cotton the advances made to them. The following year advances were stopped, and in consequence of this fewer natives planted out cotton, but those that did so suffered again from uncertain rains, the harvest being a meagre one.

In a few favoured areas the crop is being still grown by the natives, but experience has proved the general unsuitability of the Coast for the growing of cotton as a dry land proposition. Under irrigation, however, and especially along the banks of the Tana and Juba Rivers, heavy yields of cotton of good quality have been yearly obtained for the past five or six years, but for extended development of the industry in these parts a heavy outlay in irrigation works is necessary.

In the Nyanza Province, in addition to experiments conducted by the Association on their Mumias Estate, the trial plots were continued by the Government on the Kibos station, and also in various districts of the Province. In 1907-08 the results were very encouraging, but in 1908-09, owing to the abnormal rainfall, and to the fact that the cotton was planted on the flat, the yield and quality of cotton was unsatisfactory.

The experience acquired as a result of these and subsequent trials was, however, of very great value and importance towards the development of the industry on a sound basis. While in 1910-11 not quite two tons of seed cotton were exported from Nyanza, in 1911-12 and 1912-13 the harvest yielded 125 and 166 tons respectively. This year 19 tons of seed were distributed to natives, and it is estimated that the harvest will be double that of the previous year.

Much credit is due to Mr. J. Ainsworth, the Provincial Commissioner, Nyanza, and to Mr. Horne, District Commissioner, Mumias, for the manner in which they have interested the natives in the subject of cotton culture, and also to Mr. Holder, the Plant Instructor, for his itinerant work in the district.

In the past the seed used has been obtained mainly from Uganda cotton ginned at Kisumu, and arrangements have been made with the Department of Agriculture, Kampala, for seed from their Seed Selection Farms to meet our requirements for next sowing season.

CARAVONICA COTTON.—In June, 1908, small areas were planted at Malindi by the Cotton Growing Association with seed of each of the varieties known as Wool and Silk Caravonica Cotton, and trial plots were also laid out by the Government at Mazeras, but after a few years the experiments were given up, these varieties of cotton not proving successful dry land crops on the Coast. On the Tana, on the other hand, the manager of the Belagoni Estate reports favourable results on irrigated land, and purposes extending the area under the crop.

In the Kyambu district, highly satisfactory results were obtained by Mr. Coldham on his farm Anner. The farm was visited by Mr. Powell at the beginning of March, and he reports as being most favourably impressed at the vigorous growth and bearing qualities of the trees and the excellence of the seed cotton. A sample which was sent to the Imperial Institute was also favourably reported on.

As it is highly desirable that more extended experiments with Caravonica Cotton should be conducted, small quantities of seed have been issued by the Agricultural Department to various settlers in the Kyambu district, and valuable data should be available eighteen months hence.

Wattle.—Attention was first drawn in 1908 to the possibilities of a large wattle bark industry in the Highlands by Mr. D. Hutchins, then Conservator of Forests, as a result of a very favourable report received on bark produced at Njoro. In 1909 further favourable reports were obtained from the Imperial Institute on five samples of bark from trees grown at various altitudes ranging from 5,500 to 7,500 feet.

The following table summarises the results of the Imperial Institute analysis, etc. :—

Locality.		Age of trees.	% of Tannin.	Commercial value per ton.
1.	Limoru ...	5 years	38.4	£8/—/-
2.	Nairobi ...	4½ „	43.6	£8/—/-
3.	Nakuru ...	3½ „	39.6	£8/ 5/-
4.	Kyambu ...	3½ „	40.3	£8/10/- to £8/15/-
5.	Aberdare ...	6½ „	35.8	£8/10/-

It was remarked in the report that all these barks were rich in tannin, and represented material which would be readily saleable in the United Kingdom.

In Australia and Natal it is necessary to maintain wattle plantations for at least five years before they yield bark of marketable quality, and in this connection it was particularly noted that samples 2, 3 and 4 were of the richest series, though derived

from trees only $3\frac{1}{2}$ to $4\frac{1}{2}$ years old, and considered as a point of special interest. The leathers produced by these barks were all of good quality, being of pleasant light colour, of good texture, and free from harshness.

As a result of these figures and facts and subsequent supporting reports, and also of satisfactory returns for some consignments which were placed on the home markets, a number of settlers were tempted to put large areas under wattle. A further stimulant to the laying down of wattle plantations was the fact that as no coal has been found in the Protectorate a good market for firewood for railway and household requirements was likely to continue. To-day there are some 10,500 acres under wattle in the districts of Kikuyu, Limoru, and Njoro, where the soil and humid atmospheric conditions are eminently suitable for forest growth.

The question of extracting the tannin on the spot for export as against shipping the bark has lately been receiving the consideration of the planters and the Director of the Imperial Institute. The facts in favour of the proposal are (1) that a great saving in railage and sea freights would be effected, (2) that tanners, especially in the United Kingdom, show an increased tendency to use extracts rather than the raw tanning materials, (3) that the chestnut and other forests in some parts of Europe, which until now have produced large quantities of tanning extracts, are beginning to be worked out, so that there is room for the introduction of tanning extracts from outside sources. A scheme is now on foot to erect a factory at a cost of £15,000 near the Naivasha Lake, and which is about midway between Limoru and Njoro, for dealing with 7,000 to 10,000 tons of bark annually.

Apart, however, from the question of the export of bark or of tanning extracts, the establishment of a tannery for the treatment of hides and skins on the spot is one which might well be considered by our settlers acting in co-operation. For the last six years the export of hides and skins has been steadily on the increase, the value in 1913-14 being £141,093. These hides and skins could be tanned in the Protectorate, and the manufactured article exported instead of the raw materials. The small tannery at Tsavo might well be extended to cope with the work.

No fungoid has as yet been found on the wattle, but the wattle bug has done material damage in some plantations. This bug is indigenous to the country, and has transferred its habitat from the wild acacia common in British East Africa to the cultivated wattle. A further reference to this insect will be found in the report of the Entomologist.

Maize.—Maize is the staple food of the majority of the natives of British East Africa, and the area under the crop has steadily increased of late years. In 1908 there was a distinct advance observed in the European cultivation of maize, for with the increased demand by the natives for mealie meal a steady local market became established, and from the fact that two

harvests in many districts could be reaped in one year, and that the plant was found to be comparatively free from insect pests and fungoid diseases, the realisation of maize as a "cash crop" became more evident.

With the object of establishing an export trade, special reduced railway rates for maize intended for export were granted, subject to the consignment being free from weevils and sufficiently dried, and a building was erected at Kilindini for the fumigation, if necessary, of any maize before shipment.

The following statement shows the value in rupees of maize exported since the reduced rates came into force, *viz*:

1910-11.	1911-12.	1912-13.	1913-14.
106,742.	332,541.	677,608.	458,678.

It was hoped that the maize could be graded and branded prior to shipment, but owing to want of storage accommodation at Kilindini this has so far not been done, and in some instances maize of inferior quality has been shipped, which has somewhat damaged the name of East African maize. It is the intention, however, to provide, in connection with the deep sea pier construction scheme at Kilindini, a building suitable for the handling and grading of maize.

With the importation by the Agricultural Department of large quantities of maize seed of different varieties from America and South Africa, and the selection of the most suitable for the respective districts a steady improvement has taken place in the standard of maize now grown both by settlers and natives, and reports on samples sent to London indicate that maize can be raised in the Protectorate equal in quality to that from any of the other maize producing countries. Further, the yields obtained under fair average cultivation, *viz.*, 12 bags (up to 22 bags have been harvested in the Solai district) are very satisfactory.

Flax.—In 1908 trial plots were laid down at the Kabete Experimental Farm with Indian, Riga, and Pshof varieties of flax, and in each instance very satisfactory results were obtained, and especially from the Riga plots. The following year issues of seed were made to settlers in various districts, and the reports received supported the results obtained at Kabete and confirmed the view that the plant was adapted for culture in the Protectorate. Until 1911, however, the crop was mainly grown for the linseed for food for stock. In that year a flax expert from Belgium was appointed to conduct experiments with the crop for the production of fibre. Flax since grown at Kabete, Lumbwa, Gilgil, etc., has been retted and scutched, and samples submitted to authorities in Courtrai, London and Belfast. All the reports received have been very satisfactory, some of the samples being valued as high as £55 per ton. The yield also compares favourably with that obtained in the chief flax growing countries. A five acre plot grown at Kabete in 1913 produced an average of 2 tons 13 cwt. and 20 lbs. of straw per acre, from which 496 lbs. seed, 613 lbs. good fibre, and 291 lbs. waste fibre were obtained (waste fibre is valued at about £20 a ton). It has also been

proved at Kabete that the native can be trained to scutch (the most important operation in the production of flax) and turn out a highly dressed fibre, a matter of very great importance towards the development of the industry.

Lately, practical interest has been displayed by a number of settlers in flax culture for fibre production. A company has been formed at Lumbwa, and buildings and machinery are being erected for the retting and scutching of large quantities of flax, and in other districts settlers are contemplating establishing similar factories.

Wheat.—This crop has been grown in various parts of the Protectorate for several years now with variable results. Some early maturing varieties gave promising results when first sown, but the subsequent crops proved susceptible to rust, and had to be discontinued as unreliable. The slow maturing variety known as Rieti has withstood the rust to a greater degree than any of the others. Unfortunately it is weak in the straw, and the grain is poor in quality for milling purposes.

In the Njoro district, the chief wheat centre, some 250 varieties of wheat collected from different parts of the world have been experimented with in the hope that one or other would prove adapted to the locality, but with the exception of two or three *durums* all the others have proved susceptible to one or more of the three varieties of rust fungi. Some very satisfactory results have, however, been obtained from hybrids produced by artificial hybridization, and there are now 170 acres sown at Njoro with these crosses, from which a large quantity of seed should be harvested for further seeding in the district, and for distribution and trial in other districts. Experiments are also being continued at Kabete in the hybridization of wheats.

Coconuts.—Coconut culture is the principal industry on the Coast lands, and is likely to hold this prominent position, for it has been proved from many years' experience that a large area of this zone is eminently adapted for this branch of agriculture. For where soil and climatic conditions are favourable, and given good cultivation few crops will produce such satisfactory returns.

Up till about four years ago the industry was mainly in the hands of natives. Since then, however, large areas have been laid down by white planters, but development has not been so rapid as could be wished.

From a census taken last May it was estimated that there are 3,749 plantations on the Coast, on which are growing 456,600 coconut palms.

The condition of the plantations in the hands of the natives is very unsatisfactory, due (a) to the continuous tapping of the palms, and, in consequence, the lowering of their vitality to such an extent as to render them practically non-productive as nut bearers, (b) to meagre cultivation, (c) to the increase in the beetle "*Oryctes*," and (d) to fires.

The efforts that have been made to encourage the natives to pay greater attention to cultivation, to destroy the beetle, and to induce them to restrict the tapping for tembo, has met with but little success, and the Commission which was appointed by His Excellency the Governor in December last to consider the question of the improvement of the coconut industry has strongly recommended the introduction of legislation (a) to compel all plantation owners to keep their land reasonably free from under-bush, high grass, weeds, etc., so as to preclude damage by fire to such land or trees, or any land or trees adjacent thereto, (b) to compel plantation owners to remove or to destroy all dead palms, rubbish heaps, or other accumulations of dung, vegetable refuse or other matter likely to harbour or become breeding places for the beetle, (c) to impose a tax on every palm tapped for tembo.

The value of the exports of copra in 1913-14, *viz.*, Rs. 426,544 is higher than that of any previous year, which is encouraging, and this sum could be greatly increased by adopting better methods of drying. At present the copra is, as a rule, dried by the natives on open, sandy, and wind-swept ground, and very little of what is exported is free from sand.

It often happens also that the copra is insufficiently dried, and becomes mouldy during transit to the home markets. Our copra, therefore, cannot be utilised for food products, and is sold for soap making.

Rubber.—The very profitable results obtained in 1905 and 1906 from Ceara Rubber plantations on the Coast and Midland belts of German East Africa, where the conditions of climate and soil are very similar to those obtaining in corresponding zones of this Protectorate, were a sufficient temptation for a number of our settlers to lay down small plantations on their estates. The vigorous growth of the trees for the first two years, together with the fact that samples of rubber from eighteen months' old trees was valued at 3s. a lb. and upwards, was considered sufficient justification for extended cultivation. In 1907-08-09 large areas were planted out at Witu, on the Tana River, Mombrui, Magarini, Malindi, Mazeras, Ribí, and Kibwezi.

In 1910 and 1911 consignments of rubber were exported with very satisfactory results, and a number of companies were formed for further development.

With the prices ruling for Ceara rubber, planters were very sanguine, and indications pointed to rubber taking a prominent position among our industries.

In 1912, however, the price of rubber began to fall, and the following year a crisis occurred, the prices having reached a point when it was found unprofitable for our planters to continue tapping. There has since been a slight rise in prices, but not sufficient to allow of any margin of profit over cost of production.

A few planters and companies have abandoned their plantations, having expended all capital, others, having uprooted their trees, are planting out their land with coconuts and sisal, while others are resting their trees in the hopes of a further improvement in the rubber market.

But in view of the large and increasing output of Para Rubber from other countries the prospects of the Ceara Rubber industry in the Protectorate are not considered bright.

Tobacco.—The third annual report of Mr. Monson, the Adviser for Tobacco, gives the results of his experiments to date with tobacco grown in various parts of the Protectorate.

OTHER CROPS.

Fruit.—The data now available as regards citrus culture goes to show that in many districts the conditions are extremely favourable for the development of this industry, and a number of orchards are now being laid down.

Beans.—More attention is being directed to the growing of varieties suitable for export, and large quantities of Canadian Wonders and Rose Cocos are now being raised by the natives.

Peas.—This crop is found to be a very profitable one for export to London.

Arrowroot has been imported and grown at Mazeras, Kabete, and in the Fort Hall district, and the results are very promising.

Sim Sim.—The cultivation of this crop is extending in the Nyanza district, and large quantities of seed are being exported.

Rice.—The area under this crop is also being extended. Large swamps in the Mumias and Kisumu districts have been drained and brought under cultivation.

Meteorological.—The earliest records in the possession of the Department are those of rainfall observations as far back as 1890.

In 1904 the work of meteorological recording was taken over by the Department of Agriculture from the Medical Department, and in 1905 the first annual report (for 1904) was published. At that date the Department controlled 7 Temperature and 28 Rain-fall Stations.

Subsequent to this publication yearly reports have been issued for the general information of the public.

With a sum of money annually voted for the purchase of meteorological instruments new stations in the settled area of the Protectorate have been established, and at the time of writing we are monthly in receipt of observations from 28 Temperature and 136 Rainfall Stations.

The work involved in the recording of data received from 136 observers is considerably more than would appear at first sight, and it is to be regretted that, from force of circumstances, little, if any, results of analysis of figures have been undertaken.

Administrative Officers at Government Stations throughout the country have in the past rendered valuable assistance as observers, and a considerable number of owners and managers of private estates have voluntarily undertaken this work.

Observations throughout the Protectorate are taken at 9 a.m. It is quite impossible to insist on two or more readings daily, for in most cases the observer in charge, being usually single-handed, cannot be expected to confine himself to his station for the purpose of reading thermometers, and the value of frequent readings would be nullified by the necessary employment of more than one observer.

It is the intention to introduce, at an early date, Barographs and Thermographs for recording purposes at certain important stations. Such instruments, self-registering, would give interesting charts at stations which otherwise would only supply daily records.

It is not opportune here to quote, even generally, the results of observations bearing on the seasons of this Protectorate, which results, unless treated in detail, would be confusing from their diversity. Facts may be more satisfactorily obtained by reference to the separate publications of the Department.

Rainfall records for 1913 are appended, as also statement of produce raised from various stations from April, 1913, to March, 1914.

A. C. MACDONALD,

Director of Agriculture.

RAINFALL RECORDS FOR 1913.

Stg. No.	STATIONS.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL.
1	Alexandria, Goshia (D. C.)	0.00	0.00	0.10	5.86	6.75	2.95	0.47	0.50	0.52	6.46	5.86	0.00	29.47
2	Athi River (Kenani Fibre Lands)	0.00	0.94	8.37	1.53	2.34	4.83	0.00	0.20	0.00	1.38	4.17	2.76	26.52
3	Athi River Station	0.00	0.88	10.13	2.65	2.34	5.93	0.00	0.00	0.00	1.55	2.71	3.82	30.01
5	Baringo, (D. C.)	0.00	1.03	1.89	2.79	6.39	5.47	1.88	0.55	0.00	2.25	1.76	0.51	24.52
7	Chania Bridge (Henderson)	0.06	2.27	8.33	3.78	4.39	6.18	0.14	1.28	0.31	3.29	5.68	1.47	37.18
9	Dagoretti (Forest Station)	0.00	1.63	6.81	3.05	4.95	3.37	0.00	0.23	0.00	2.38	2.49	2.16	27.10
11	Eldama Ravine, (D. C.)	0.02	3.29	4.99	3.78	5.84	8.35	4.36	1.56	1.30	1.87	2.69	2.07	40.12
12	Elmenteita (Chamberlain)	0.17	1.15	4.35	3.69	2.83	6.94	0.91	0.71	0.75	3.27	1.87	1.37	27.92
13	Embu, (D. C.)	0.16	1.69	4.23	4.74	8.89	5.07	0.71	0.85	0.38	7.28	5.81	3.14	42.95
15	Fort Hall, (D. C.)	0.02	3.20	11.20	5.46	8.42	2.94	0.18	0.61	0.00	5.25	5.90	1.15	44.33
17	Fort Ternan (Ross Bros.)	0.00	0.00	1.55	7.60	5.06	7.22	2.58	0.87	2.33	0.63	2.98	3.61	34.43
19	Gazi, (E. A. Estates)	0.01	0.80	6.70	20.56	12.49	7.38	2.18	3.10	3.29	4.31	1.19	3.40	65.40
20	Gendia Mission, (Congo Bay)	0.13	5.01	3.27	5.48	5.15	8.44	3.38	0.71	0.85	2.48	1.93	3.65	40.48
23	Hona Bay (Customs)	0.00	8.40	3.04	4.94	7.88	3.86	5.80	2.58	1.00	2.95	3.23	3.13	46.81
27	Kabete Farm (Nairobi)	0.08	2.59	11.00	3.84	5.14	3.02	0.06	1.12	0.14	2.92	2.20	2.13	34.24
28	Kakamega (R. C. Mission)	0.00	3.05	8.63	11.16	9.77	10.53	6.93	6.03	2.37	4.05	4.13	4.63	71.33
29	Kwale (Forest Station)	0.00	0.00	4.68	8.01	7.21	8.48	2.15	2.3	2.49	4.47	0.00	0.00	39.52
30	Kamiti Downs, Kyambu (Relly)	0.05	3.06	9.67	5.74	4.89	4.16	0.75	0.64	0.00	2.74	4.39	2.06	38.15
31	Karuru (Forest Station)	0.06	2.54	8.82	3.64	3.39	4.16	0.00	0.42	0.11	1.48	3.34	2.75	30.71
32	Karungu, (Customs)	0.31	2.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.51	3.51	4.99	12.76
33	Kericho (Orchardson)	0.18	5.51	5.17	10.37	11.36	7.45	4.93	3.28	2.02	5.31	4.04	3.40	63.07
34	Kericho (Lumbwa Indl. Mission)	0.00	5.14	5.55	9.51	15.07	8.30	4.53	2.42	1.63	5.06	3.76	4.02	65.05
35	Kericho, (D. C.)	0.97	5.01	5.95	9.03	10.86	8.50	5.87	2.93	1.65	4.54	4.60	4.93	64.85
36	Kyambu, (D. C.)	0.15	3.27	9.54	4.21	5.06	4.06	0.00	0.64	0.01	2.53	3.43	2.11	35.01
37	Kyambu Karumaini (Harries)	0.08	1.23	6.08	3.45	2.98	4.78	0.17	0.12	0.00	1.77	5.43	1.96	28.05
38	Kyambu, Ruika (Fletcher)	0.00	2.82	4.57	2.61	2.53	5.38	0.16	0.40	0.00	3.00	5.65	2.70	29.82
40	Kismayu, (D. C.)	0.66	0.00	4.30	0.35	4.29	2.03	1.11	2.05	0.27	0.60	2.41	0.00	13.71
41	Kipwezi (Hollins Estate)	2.66	2.22	4.30	7.89	1.70	4.07	0.00	0.00	0.00	0.78	1.19	3.40	24.56
43	Kipini (D. C.)	0.56	0.91	1.22	6.17	14.60	4.07	0.52	1.44	0.93	1.93	1.46	0.56	34.37
44	Kisii (D. C.)	0.76	7.37	7.07	9.68	9.60	7.24	2.99	2.90	2.33	6.31	5.73	4.32	66.30
45	Kibos Government Farm	0.31	3.15	8.21	9.27	3.17	2.10	3.40	2.70	0.83	1.60	2.60	4.34	41.68
46	Kikuyu, (C. of S. Mission)	0.00	3.00	9.49	5.00	3.05	2.45	0.00	1.20	0.00	2.40	2.69	2.95	32.23

Rainfall Records for 1913 (Continued).

Reg. No.	STATIONS.	Jan.	Feb.	Mar.	Apr.	May	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
47	Kisumu (P. C.)	0.54	2.27	10.89	7.06	5.52	4.65	2.64	1.52	0.91	2.50	2.54	2.07	43.15
49	Kitui, (D. C.)	0.90	5.38	11.33	10.75	2.17	0.10	0.04	0.00	0.09	8.80	8.94	3.54	52.04
50	Kin, Station	0.90	0.60	14.70	11.50	6.40	2.36	0.00	0.00	0.00	8.80	8.94	3.93	42.77
51	Lari, (Forest Station)	0.48	2.26	15.44	9.85	8.71	5.44	0.31	1.30	0.26	4.63	3.67	3.51	55.86
52	Lamu, (D. C.)	0.00	0.00	1.35	9.78	16.29	3.56	1.07	4.00	2.07	0.30	0.09	0.00	38.51
53	Linorui, Caimeville (Caine)	0.85	3.20	13.09	10.26	8.89	6.15	0.52	1.20	0.67	3.19	3.75	2.08	53.85
54	Limora, Cloverdale, (Conybeare)	1.41	1.89	11.93	7.93	7.48	4.91	0.47	0.90	0.59	2.64	2.68	1.59	44.42
55	Limora, Hope Farm (Imbey)	0.30	2.91	11.66	9.91	6.20	5.43	0.09	0.95	0.91	2.13	3.74	2.73	46.96
56	Londiani (Forest Station)	0.04	3.25	3.37	4.92	4.77	9.57	4.98	2.02	0.44	1.23	2.42	2.76	39.77
58	Londiani (Tinderet Estates)	0.48	4.05	6.40	10.59	11.99	8.01	3.80	3.95	1.79	3.02	3.57	3.31	60.96
59	Lumbwa, Station	0.00	3.23	7.02	5.64	9.10	10.63	2.70	1.65	2.05	2.69	2.50	4.89	52.10
60	Lumbwa, Industrial Mission)	0.07	2.98	5.68	7.29	9.58	10.92	7.43	2.26	0.57	4.22	2.02	3.37	56.45
64	Machakos, (D. C.)	1.02	3.69	19.77	4.27	4.13	2.41	0.00	0.56	0.08	5.18	3.56	2.42	47.09
65	Mackinnon Road Station	0.80	0.65	6.00	6.69	4.68	0.16	0.25	0.47	1.11	1.83	1.23	0.85	24.72
66	Makindu, Station	2.12	1.50	2.70	3.63	0.59	0.00	0.00	0.00	0.00	1.61	1.60	3.97	17.72
67	Malindi, (D. C.)	0.43	0.30	1.87	8.14	22.09	8.00	1.93	1.11	1.74	0.99	0.14	0.00	46.74
70	Maseno, (E. A. Industries)	0.00	3.75	8.83	7.48	7.30	4.68	1.41	3.64	1.79	6.12	2.46	2.67	50.13
71	Masongaleli, Station	3.05	2.63	2.88	6.78	0.05	0.00	0.00	0.00	0.00	0.00	1.74	2.98	20.11
72	Mazeras, Station	2.50	1.35	8.10	11.10	12.64	0.90	0.00	1.03	4.03	1.35	0.30	0.00	43.35
73	Mombasa (Mto Panga Estates)	0.00	0.36	3.53	12.33	16.13	3.12	1.94	2.88	4.73	2.84	0.41	0.40	43.67
75	Mombasa, (Nyalı Sisal Estates)	0.00	0.89	3.70	10.86	14.44	2.91	2.60	2.15	3.97	1.92	0.43	0.00	43.87
76	Mombasa, (D. C.)	0.02	0.37	3.42	11.60	12.51	2.50	2.85	1.72	3.48	4.05	0.11	0.25	42.88
77	Molo Over Haddon (Abrahams Bros.)	0.29	3.55	9.15	5.60	9.46	11.15	10.74	5.93	2.00	3.18	1.35	3.51	65.91
78	Molo, Station	0.09	8.85	4.42	6.15	8.36	9.98	7.05	2.55	0.50	1.95	4.09	4.08	53.07
81	Mumias, (D. C.)	0.00	3.49	6.53	11.69	9.05	9.03	6.05	3.21	1.22	6.30	3.08	1.88	61.53
83	Muhoroni, Station	0.00	4.30	5.66	2.31	5.40	6.30	0.45	2.96	3.00	4.47	2.35	2.60	39.80
86	Muhoroni (Webb)	0.69	5.78	5.60	9.54	4.85	8.14	1.82	2.17	1.63	2.83	2.30	8.65	54.00
92	Nairobi, Station	0.00	2.48	8.93	4.20	5.06	4.00	0.00	0.42	0.00	1.51	2.81	2.55	31.99
93	Nairobi Hill (Wood)	0.07	2.64	9.45	3.69	4.97	2.86	0.02	0.62	0.01	1.05	2.95	2.71	31.04
94	Nairobi, (P. W. D.)	6.07	2.25	7.88	4.24	5.13	3.14	0.00	0.39	0.15	1.48	2.89	3.50	31.12
95	Naivasha, Station	0.14	2.14	7.72	2.36	2.70	4.39	0.00	0.00	0.08	1.16	1.08	1.79	23.56
96	Naivasha, (P. W. D.)	0.10	1.11	5.82	1.78	2.60	3.79	0.17	1.06	0.63	0.84	1.71	0.88	20.42
97	Naivasha, M'berrish (Marten)	0.18	0.11	4.35	3.97	1.77	8.58	0.67	0.50	0.55	1.17	0.43	1.70	23.98

Rainfall Records for 1913 (Continued).

Reg. No.	STATIONS.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	TOTAL.
98	Naivasha, Rustenburg (Barry)	0.00	1.49	6.07	2.98	2.47	9.95	2.66	0.73	0.00	1.27	1.63	2.05	31.30
99	Nakuru, (D. C.)	0.00	1.68	3.17	4.42	5.18	9.05	5.22	0.91	0.20	2.31	3.39	0.71	36.86
100	Nakuru, Station	0.00	1.49	3.30	4.26	7.22	8.34	4.43	0.70	0.20	2.31	1.91	0.85	35.03
102	Nandi, (D. C.)	0.00	5.60	5.71	5.81	11.11	8.66	9.74	6.70	1.20	4.11	2.89	5.24	66.77
104	Naivasha, Njabini (Capt. Fey)	0.52	2.72	12.94	7.36	6.80	6.24	0.84	1.07	3.02	3.39	5.27	2.53	52.70
105	Nyeri, (D. C.)	0.89	0.84	6.16	10.40	4.48	4.48	0.00	0.24	0.62	3.03	4.27	0.69	43.12
107	Ngobok (D. C.)	0.00	2.95	1.18	8.55	7.73	2.10	0.03	0.18	0.00	0.77	3.82	1.36	28.67
108	Ngongo Bagas, (D. C.)	0.00	2.75	10.34	5.64	2.20	3.68	0.00	0.28	0.00	0.00	1.85	3.50	30.24
110	Njoro Thurland (Tur. Hall)	0.15	1.38	5.28	6.88	5.03	8.60	2.61	1.10	1.54	2.39	4.20	2.23	41.39
111	Njoro (Fawcus)	0.07	0.73	4.00	3.85	4.15	7.26	2.67	0.98	0.80	2.38	2.45	1.12	30.46
114	Port Florence Station	0.53	1.42	10.99	7.78	4.70	3.47	2.99	1.86	0.72	3.01	2.42	2.51	42.40
116	Rabai, (D. C.)	0.15	1.30	7.85	11.32	10.16	1.70	1.10	1.71	2.51	2.07	0.20	0.00	40.08
119	Shimoni, (D. C.)	0.03	0.79	8.05	17.99	14.34	5.77	1.72	1.82	3.95	2.70	0.76	5.90	63.82
120	Sotik, Nyangoris Park, (Morgan)	1.28	5.04	9.12	10.91	4.95	5.71	2.33	1.92	1.51	3.31	6.15	5.69	57.92
123	Takaungu, (D. C.)	0.00	0.41	3.25	12.17	14.16	5.01	0.70	2.01	2.36	2.40	1.83	0.00	44.30
124	Taveta, (D. C.)	2.63	1.36	5.07	8.34	2.38	0.00	0.00	0.00	0.30	0.65	2.05	5.53	28.31
125	Thika, N'daruga, (Lindsay)	0.04	1.99	6.07	6.77	3.60	5.67	0.05	0.77	0.29	2.29	4.03	3.08	34.75
126	Thika (Trotter)	0.20	3.61	8.00	4.78	1.92	9.46	0.00	0.33	0.00	2.68	7.75	1.87	40.60
129	Uasin Gishu, Mooi Ben, (Cap. Chapman)	0.00	7.00	2.75	11.34	7.98	11.78	6.02	4.20	0.73	2.50	0.00	0.00	54.30
131	Uasin Gishu, Eldoret, (D. C.)	0.00	4.30	0.98	4.75	6.83	9.30	13.14	2.96	2.45	0.30	0.50	2.59	48.10
132	Uasin Gishu, Farm 225 (Johnson)	0.00	3.40	5.59	3.97	7.88	8.95	6.84	3.58	1.20	2.35	2.04	1.08	46.88
133	Uasin Gishu, Farm 121-122 (Smith and Lovemore)	0.04	3.23	6.40	5.76	5.21	8.96	5.95	4.21	0.76	1.78	1.70	0.88	44.88
138	Voi, (D. C.)	1.62	0.49	5.12	2.46	1.40	0.00	0.00	0.03	0.09	1.07	0.31	1.62	14.21
139	Voi, Station	1.82	0.63	8.32	5.24	1.59	0.00	0.00	0.00	0.00	2.10	0.52	2.05	22.27
143	West Kenya, Forest Station	0.50	2.61	3.15	8.67	6.55	5.86	1.81	1.25	1.67	5.58	6.73	4.53	48.91
145	West Kenya, Farm 1234 (Kenealy)	0.98	2.68	3.34	4.80	1.93	3.80	0.05	0.51	0.21	2.74	4.33	2.42	27.79
147	Wire Hill, (7th Day Advent Mission)	0.25	3.94	6.04	5.73	12.11	7.32	3.42	1.72	0.42	4.11	2.32	3.23	50.61
148	Wusi, Voi, (C. M. Society)	3.85	1.47	4.82	17.37	5.60	0.74	0.41	0.12	3.26	0.78	4.78	8.83	52.03

Statement Showing Weights of Produce Railed from the undermentioned Stations from April 1913 to March, 1914.

STATION.	Wheat.		Beans.		Peas.		Coffee.		Maize.		Potatoes.		Sim-Sim.		Ground Nuts.		Rubber.		Fibre.		Cotton.		Bacon.		Butter.		Cheese.	
	Ts.	Lbs.	Tons.	Lbs.	Ts.	Lbs.	Ts.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Tons.	Lbs.	Ts.	Lbs.	Ts.	Lbs.	Ts.	Lbs.	Ts.	Lbs.	Ts.	Lbs.	Ts.	Lbs.		
Voi	Nil	...	2	310	Nil	...	Nil	...	54	1,720	...	330	Nil	...	Nil	...	Nil	...	285	1,240	1	100	Nil	...	Nil	...	Nil	...
Masongelani	"	...	...	250	"	...	"	...	190	1,400	...	1,340	"	...	"	...	"	...	31	700	Nil	...	70	...	...	...	"	...
Kibwezi	"	...	...	800	"	...	"	...	613	600	...	700	"	...	...	1,220	9	640	Nil	...	"	...	Nil	...	...	...	"	...
Makindu	"	...	...	630	"	...	"	...	20	470	...	200	...	850	...	190	Nil	...	"	...	60	...	...	...	...	...	"	...
Ulu	"	...	...	1,170	"	...	"	...	Nil	...	Nil	...	Nil	...	Nil	...	"	...	"	...	Nil	...	...	...	...	...	"	...
Nairobi	10	940	1,133	620	187	370	268	1,730	438	530	172	1,900	"	...	160	20	...	380	235	770	...	1,140	...	220	...	...	"	...
Kikuyu	Nil	...	243	940	3	1,440	...	1,170	1,103	1,670	118	30	"	...	Nil	...	Nil	...	Nil	...	Nil	...	Nil	...	...	...	"	...
Limuru	2	60	117	1,010	21	1,340	...	2,210	1,775	1,670	2,449	290	"	...	...	80	...	"	...	3	1,450	...	21	1,240	...	240	...	
Nakuru	...	2,120	20	900	1	1,330	...	200	357	590	2	180	"	...	...	220	...	...	Nil	...	"	...	Nil	...	...	...	"	...
N'joro	200	1,850	46	1,260	13	940	Nil	...	187	1,250	4	1,050	"	...	...	60	...	...	"	...	"	...	...	...	...	...	"	...
Molo	Nil	...	1	2,030	...	10	"	...	85	1,070	1	1,700	"	...	Nil	...	...	...	"	...	"	...	...	...	...	...	"	...
Londiani	...	...	1	1,650	...	670	...	50	38	710	...	1,550	"	...	...	130	...	...	"	...	"	...	...	40	390	...	"	...
Lumbwa	12	2,100	...	380	...	710	Nil	...	34	110	3	1,780	...	90	...	100	...	380	"	...	70	...	120	16	740	2	20	...
Mahoroni	Nil	...	2	1,140	Nil	Nil	...	30	155	840	...	360	Nil	...	Nil	...	Nil	...	"	...	Nil	...	Nil	...	Nil	...	Nil	...
Kibos	"	...	7	1,440	"	"	...	370	687	400	Nil	...	12	60	"	...	"	...	"	...	"	...	"	...	"	...	"	...
Kisumu	4	1,716	114	1,490	"	"	2	1,670	8,207	2,150	...	200	2,485	2,090	381	670	"	...	21	2,020	1,590	700	"	"	"	"	"	...

ANNUAL REPORT
ON THE
ECONOMIC PLANTS DIVISION
FOR THE
FINANCIAL YEAR ENDING 31ST MARCH, 1914.

DEPARTMENT OF AGRICULTURE,

MOBASA,

21st May, 1914.

THE HON. A. C. MACDONALD,

Director of Agriculture,

NAIROBI.

SIR,

I have the honour to forward herewith the Annual Report on the Economic Plants Division for 1913-14.

2. During my absence on leave I shall hope to write up several articles of economic interest for probable publication in the *Agricultural Journal*.

I have the honour to be,

Sir,

Your obedient servant,

(Signed) H. POWELL,

Chief of the Economic Plants Division.

Inspection Tours.

Practically the whole of the time of the Chief of the Economic Plants Division was given up to inspection in one way or another. Several months were devoted to a tour of the Uasin Gishu Plateau, undertaken at the special request of His Excellency the Governor for the purpose of examining the soil on many of the farms there, and to advise the farmers, as far as possible, what crops would be likely to do best. Samples of the soil were collected on a large number of the farms for analysis by the Government Analyst at Nairobi.

On the conclusion of the tour, which embraced parts of the Trans Nzoia country, a representative meeting of the Plateau farmers was addressed at Eldoret, and the conclusions arrived at by the writer were made known.

Following the completion of the Uasin Gishu tour, an inspection was made of a number of the Muhoroni and Lower Londiani allotments. Here in the upper parts are rich sheltered valleys where Arabian coffee, maize and other crops thrive to perfection. As a matter of fact so well is coffee doing that at the present rate of planting, and judging by the rapid, strong, and healthy growth of the trees on the parts already established, this district promises to rival the Kyambu and adjoining districts in the matter of coffee production.

Coffee is also thriving on the small plots established on several of the estates visited in the Lumbwa district, but here the growth is slower than in the Upper Muhoroni country.

An exhaustive tour was made of the native cotton plots and rice shambas in the Yala River, Mumias and Sio districts, and a full report duly submitted thereon. The success already attained by the natives of parts of the Kavirondo country is of a highly encouraging nature, and the possibilities for the production of both of these valuable economic staples are immense.

The rich Molo River Valley, as were parts of Kyambu, Masongaleni and places at the Coast, also received visits. Unfortunately an attack of Blackwater Fever prevented the writer giving as much attention to the Coast as could have been desired, and had a change not been made to the Highlands it is probable a trip to Europe would have had to be undertaken.

MAZERAS EXPERIMENTAL STATION.

Whatever time could be spared was given by the Chief of the Division to this experimental station.

The rainfall was the lowest registered for many years, and as a result the plants suffered considerably from drought.

Notes on some of the more important economic plants under trial are given hereunder:—

Coconuts.—A six-acre plot has been established at the Mazeras Experimental Station with six months' old plants raised from specially selected nuts grown on strong, healthy and untapped trees, on the United Methodist Church's fine plantation at Ribe, and of which 92 per cent. germinated. Another season the area under selected coconuts at Mazeras will be increased, the main object in view being to later on provide a source of supply of reliable seed-nuts for intending planters, as well as the carrying out of cultural and manurial experiments on modern lines.

The year under review witnessed increased activity in coconut planting, both by Europeans and natives. Sand considered suitable for coconuts is being eagerly sought after, and there are indications that we are on the eve of a boom in coconuts of a much similar nature to that of the rubber boom of recent date. A word of warning at this juncture may, therefore, not be out of place. The greater part of the strip of coastland on which coconuts are already more or less established is undoubtedly eminently suited to the coconut palm, but even in this area, and more particularly in the immediate hinterland, there are stretches of heavy, clayey, tenacious land, quite unfit for the successful growth of the valuable tree under notice. Intending planters of coconuts should be careful to select blocks of land on which there is a good proportion of rich, fairly deep, friable soil, inclined to the sandy side, in which the coconut palm delights.

Instances are seen here and there of fully developed trees in unsuitable soil that scarcely produce a single nut. It is true that sterility of the trees is also often due to neglect of proper cultivation and manuring. As a matter of fact it has been demonstrated recently that unproductive coconut trees, in a neglected condition, had by means of proper attention been induced to bear good crops.

The coconut industry has always held, and still holds, the premier position of all industries at the Coast, and there is no doubt whatever that, taking into consideration the largely increased areas put under coconuts during the last three years, together with the present rate of planting and the efforts now being made by the Government towards the destruction of the Coconut Beetle (*Oryctes*), an even brighter future is in store for coconut growers in the coast littoral of British East Africa.

Estimate of Cost of Planting an Acre of Coconuts.—The following estimate of the cost of planting an acre of coconuts, and the bringing of same to a bearing age, may prove useful as a guide to intending planters:—

	Rs.	cts.
(a) Cost of clearing and stumping an acre of thick bush land	60	00
(b) Cost of clearing an acre of medium thick bush land	30	00
(c) Cost of clearing an acre of ordinary grass land ...	15	00
(d) Cost of lining, holeing and planting at 25ft. by 25ft. say 70 holes to the acre, the holes to be 2½ft. wide and 2½ft. deep.	10	00

- (e) Cost of coconut plants to be grown from specially selected nuts, obtainable at the rate of Rs. 90 per 1,000. Say 100 nuts to the acre, in order to allow for failures in germination, injury by wild pigs, etc. ... 9 00
- (f) Annual cost of weeding an acre of coconuts. Six weedings per annum ... 18 00
- (g) Total cost of weeding an acre of coconuts during the 6½ years, plus six months in the nursery the trees usually take to arrive at a bearing state ... 117 00
(It is probable that during the last three or four years less than six weedings a year would suffice).
- (h) Total maximum cost of planting an acre of coconuts and caring for same to the bearing state 196 00

It will be observed that in the foregoing estimate no charge has been allowed for purchase of land, or management, etc.

Sugar Cane.—The large plot of sugar cane which had been running for some years, mostly for nursery purposes, has been removed and a new one established on fresh land at the Experimental Station, Mazeras.

A batch of 2,000 specially selected plants was supplied to Messrs. Dean, Masongaleni, where the gentlemen named are taking up the cultivation of the sugar cane for commercial purposes.

Sugar cane plants were also supplied to several others interested therein.

A small consignment of the “Uba” sugar cane was imported direct from Natal during the year, and is being grown at the Government Experimental Stations of Kibos and Mazeras.

The following varieties of the best sugar producing plants were also imported during the year from Antigua, through the good offices of the Imperial Commissioner of Agriculture for the West Indies:—

Sealy Seedling.

B 147, B 156, B 4596, B 1528, B 3922.

Of the six varieties named above all, with the exception of B 156, came to hand in a perfectly fresh state, although they had been several weeks on the way out, enclosed in sealed tins containing damp powdered charcoal. Half the consignment of each variety was planted at the Government Experimental Farm at Kabete, and the other half at Mazeras, where they are growing freely. Propagation will be carried out as fast as possible, and trial plots established. It is hoped that in a year or two plants of these rich sugar producing canes will be available to intending planters.

In view of the large amount of sugar imported into the Protectorate, and the interest now being awakened in sugar cane planting, it is not too much to say that the introduction of these valuable up-to-date plants is likely to be of extreme importance, and may be regarded as among the most useful of the various members of the vegetable kingdom as yet brought into the country.

Fruit Growing.—Special features of the Mazeras Experimental Station are provided in the several plots devoted to the cultivation of choice varieties of pine-apple, banana, giant papaw, orange, etc. Apart from these plots proving serviceable in the matter of furnishing object lessons in fruit growing, considerable revenue is derived from the sale of produce and plants. During the past season regular consignments of fruit were supplied, on purchase, to His Excellency the Governor, also to the Staff of the Magadi Railway, and the Officers of the Agricultural and Veterinary Departments. There was a keen demand for plants of the several varieties of fruits named above. The plot of choice pineapples has been doubled in size, and accordingly there will be a greater quantity of this fruit available during the coming season.

Cocoa.—Months of drought destroyed all chance of the cocoa plants producing mature pods of “beans” during the year. Nevertheless they came through the severe test fairly well, and, given a normal season, fruit should be forthcoming at an early date.

The Madura (*Gliricidia Maculata*) trees hardly furnish sufficient shade for cocoa at Mazeras; hence rows of the Rain Tree (*Pithecolobium Saman*) are being established in the cocoa plot. The Rain Tree flourishes at Mazeras, as it is also doing at the Railway Stations Maji Ya Chumbi and Samburu. Seeds of this tree have recently been distributed about the Protectorate from the Mazeras Experimental Station.

Citrus.—Deliciously flavoured, juicy, thin-skinned large oranges were borne for the first time on several of the trees on the Mazeras trial station. The trees were raised from seed selected from the Zanzibar orange, and is proof that seed-raised oranges can be relied on to breed fairly true, though for the Home market, where graded fruit is required, budded trees are undoubtedly best.

The various varieties of budded orange trees have come on quite satisfactorily, and will probably fruit next season.

One apparant advantage of coast grown oranges over those produced in the Highlands is the thinner rind, and there is also a tendency to greater juiciness and sweetness.

The thickness of the rind of the Upland grown oranges will, it is evident, be their chief defect when the time arrives for placing such fruit on the Home or other outside markets.

Lime.—Both the spine and spineless varieties of lime produced fair crops of fruit, the seeds of which are being used for propagating purposes.

From time to time attention has been drawn to the great possibilities for lime culture in parts of the Protectorate, and especially is this so in the Kibos district and surrounding country. Several large landowners are now becoming interested in the subject, and have stated their intention to later on take up the manufacture of " Citrate of Lime."

Some years ago a consignment of lime seeds was obtained from Dominica, West Indies, and bearing trees are now to be found at the Old Government Farm, Nairobi; also at Kibos, Mazeras, and other places.

Kapok or Silk Cotton.—Good growth was made by these trees, and experiments in the pruning of several were carried out with a view to restricting their height, and at the same time encourage a more lateral spread of the branches, so as to ensure easier facilities in the gathering of the ripe capsules. Two varieties of " Eriodendron " are under trial, *viz.*, the local " Msufi " and one from Java. Another year data as to the yield of this interesting plot will most likely be available.

Nakuru Agricultural Show.—Following the custom of previous years, the installation of the exhibit of the Department of Agriculture was entrusted to the Chief of the Economic Plants Division, who also took part in the judging of several classes.

A selection was made of prize and other products at Nakuru for exhibiting at the International Cotton, Tropical Products and Allied Trades Exhibition, to be held in London during the latter part of June and the early part of July, 1914. Both as regards variety and quality the exhibits exceed anything previously shown from the Protectorate, and cannot fail to attract attention to the potential resources of British East Africa.

Government Experimental Farm, Kibos.—Two or three visits were paid to the Kibos Farm during the year, and a full report on same was submitted.

The general work of the farm will be dealt with as usual by the Plant Foreman Instructor.

Government House Grounds and Public Garden, Mombasa.—These institutions remained under the control of the Department of Agriculture, but suffered much damage during the prolonged dry weather. Much re-planting is being done at the time of writing to replace lost specimens.

ANNUAL REPORT

OF THE

GOVERNMENT EXPERIMENTAL FARM, KIBOS, AND AGRICULTURAL INSTRUCTION WORK

FOR THE

YEAR ENDING 31ST MARCH, 1914.

THE HONOURABLE THE DIRECTOR OF AGRICULTURE,
NAIROBI.

SIR,

I have the honour to submit my annual report on the Government Farm, Kibos, and the Agricultural Instruction work undertaken by me in the Kisumu and Mumias districts for the year ending 31st March, 1914.

Rainfall and Weather Conditions.—Although the distribution of the rains over the period covered by the long rainy season was not as even as might have been wished, the quantity of rain which fell was ample for the purposes of maturing the crops planted in the district. This, however, cannot be said of the short rains, which were a complete failure throughout the whole of the Kavirondo country, a circumstance which led to the complete failure of the most important native export crop, *i.e.*, Sim-Sim, throughout the Nyanza Province.

High easterly winds were especially frequent during the dry months towards the end of the year, as were also thunderstorms at the beginning of the long rains.

Two light hailstorms occurred in April, but beyond the blowing over of the storeroom the damage done by these storms was slight.

The following is a table showing the rainfall during the long and short rainy seasons for the year ending 31st March, 1914. The rainfall for the previous year—8.40 inches—should be, of course, included when considering this table.

RAINFALL for 1913—1914.

Month.	Quantity in inches.	No. of days, on which rain fell.	Greatest Fall.	
			Date.	Inches
LONG RAINS.				
April	9.29	14	3rd	1.94
May	3.17	8	18th	0.88
June	2.10	4	1st	0.80
July	3.40	5	10th	1.70
August	2.70	6	21st	0.60
SHORT RAINS.				
September	0.83	2	3rd	0.60
October	1.60	5	29th	0.35
November	2.60	3	4th	1.63
December	4.30	5	11th	2.56
January	0.23	1	2nd	0.23
February	0.03	1	26th	0.03
March	4.78	8	27th	1.37
Total	35.03	52		...

Nurseries.—The further extension of the area devoted to the above was made this year. This was done in order to meet both the outside as well as the Farm requirements for seedlings of coffee, timber, fruits, etc., the raising of which latter necessitated the making of several thousands of banana leaf pots and a number of beds 20 feet long and 4 feet wide.

All the old beds were thoroughly renovated with farmyard manure, and such matters as watering, weeding, shading, etc., were given special attention.

The following is a list of the more important plants raised, planted out or distributed from the nursery during the year:—Coffee, Chillies, Eucalyptus, Black Wattle, Iron Wood, Grevelea Robusta, Limes, Lemons and Tobacco.

Crop Experiments.—The above were divided into permanent and short crops, these latter consisting of main and catch crops, and grown on similar lines to those of previous years.

As mentioned under "Weather Conditions," the trials conducted during the long rainy season were with few exceptions productive of good results, the failures recorded being the result of unfavourable soil conditions brought about by the heavy downpours of rain which followed one another in close succession during the months of March and April.

These crop experiments continue to attract considerable interest amongst local Indian settlers, a number of whom have actually started trials with some of the more important of the crops being tried at the farm other than maize.

The catch crop experiments elicited a number of enquiries, especially from a section of the Muhoroni farming community, who were anxious to find a suitable one to grow in conjunction with coffee.

The following is a table showing the area occupied by the various crops under trial during the year:—

Name of crop.	Main crop acres.	Catch crop acres.	Permanent crop acres.
Beans ...	—	4	—
Sugar Canes ...	1	—	—
Coffee ...	—	—	3½
Cotton ...	10	—	—
Ground nuts ...	—	3	—
Linseed ...	—	4	—
Sim sim ...	5	—	—
Tobacco ...	—	3½	—
Chillies ...	—	4	—
Bananas ...	—	—	4
Timber ...	—	—	4
Fruits ...	—	—	3
Maize ...	15	—	—
Total ...	31	18½	14½

Beans.—This experiment included three varieties, as follows:—

- (1) Canadian Wonder.
- (2) Rose Cocos.
- (3) Moldavia Round White.

The Canadian Wonder, which was tried for the first time at the Farm this season, gave better results than the other two, but owing to the more favourable weather which prevailed during the growth of this variety it was impossible to make a fair comparison between the yielding qualities of the three varieties.

Much progress is being made with the cultivation of the Canadian Wonder variety by the natives in the Kisumu and Mumias districts, who are being encouraged to grow the crop in the swamps which have been cleared for rice, and in view of the greater care being exercised over the keeping of the variety pure, there appears every reason to expect that this crop will soon take its place besides those at present being grown by the natives of the Kavirondo country for export.

The following is a table of results :—

Variety.	Area.	Planted.	Reaped.	Average Yield per acre.
Canadian Wonder ...	2	May 4th	Aug. 10th	250 lbs.
Rose Cocos ...	1	Sept. 9th	—	no return.
Moldavia ...	1	Sept. 10th	—	no return.

Castor Seed.—Various attempts have been made during the past four years to grow this crop in the Kisumu and Mumias districts, but owing to one cause or another very little progress in doing so successfully has been made to date.

It was suggested that the chief cause for this failure was the fact that the seed used for planting was introduced into the districts in which plants occurred growing wild and bearing profusely, and that better results were likely to accrue from seed selected from such plants.

This led to the present experiment, which was conducted with a small seeded variety collected from plants growing wild round about the Kibos farm. The preparation of soil was carried out in the same way as for maize, with the addition that before sowing the soil was raised in little hills, on the centre of which three seeds were sown at the beginning of the rains in April.

The early growth of the young plants was good, but only two-fifths of the whole plot of five acres was carried to the end of the experiment.

After attaining a height of from 5 to 6 feet from the ground, the tops of the plants were pinched off, to encourage a spreading habit.

The first fruit heads or capsules were gathered six months from date of planting, and harvesting continued at intervals for two months. These capsules were laid in the sun, where they burst open, liberating the seed after a few hours' exposure.

Various enquiries have been made regarding the result of this experiment by interested persons, and it is proposed to continue these trials until some definite information regarding the yield, etc., has been obtained.

The following is a table of results :—

Variety.	Area.	Planted.	Reaped.	Average Yield per acre.
Castor Seed, small ...	5	April 7th	Oct. 11th	250 lbs.

Chillies.—It was arranged to put under a three acre plot with three varieties of chillies, *viz.*, Nyassaland and Jinja—two small varieties—and the long, or Mombasa, variety, seed of each of which was sown in the nursery during the middle of February of the previous year.

Owing to the slower growth of the smaller varieties in the nursery the seedlings were not put out in the fields till rather late respect, the harvest being complete in from eight to nine months in the season, with the result that the harvesting of the crop commenced too late for the inclusion of the results in the present report.

The long, or Mombasa, variety proved much better in this respect, the harvest being complete in from eight to nine months from date of sowing in the nursery. This latter variety is extensively grown at Kibos by the Indians, and is preferred by them on account of its early maturing qualities and the greater ease with which the crop can be harvested compared with the small varieties.

Although these small varieties ought hardly to be recommended for cultivation in districts where the labour supply is not cheap and plentiful, the better market prices which they always command over the large varieties—something like £6 per ton, more—together with the fact that the crop could be treated somewhat like a perennial for a certain number of years, which saves the necessity for replanting every season, are points worthy of consideration.

The following is a table of results:—

Variety.		Area.	Planted.	Reaped.	Average Yield per acre.
Mombasa	...	3	April 17th	Aug. 30th	362 lbs.
Nyassaland	...	$\frac{1}{2}$	—	—	no return.
Jinja	...	$\frac{1}{2}$	—	—	no return.

Cotton.—An eight-acre experiment was conducted with this crop on the side of the main road leading to the railway line. This site was chosen so that the experiment, owing to its easy accessibility, might serve to demonstrate to persons interested in cotton growing, especially the Indians, who in the early days of settlement at Kibos made unsuccessful attempts to grow the crop, the line of procedure which was found suitable in growing cotton successfully at Kibos.

The preparation of soil was carried out in the same manner as heretofore. Planting, which commenced in April, was continued, as the weather proved favourable, till the middle of June, the seed for the purpose being obtained through the British East African Corporation, Ltd., as heretofore. On the whole, germination was good, but owing to a break in the weather at a rather critical period the late planted section of the experiment produced rather poor results. This failure of the rains was also indirectly responsible for the somewhat high percentage of stained cotton the crop contained. Premature opening of bolls usually occur during the lengthy periods of drought. This, as in the present case, admits the entry of insects and rain water before the lint is fully matured, with the result mentioned above.

A series of distance experiments, *viz.*, 4 ft. by 2 ft. and 5 ft. by 2 ft., was again carried out this season, but the partial failure of the latter planting through the drought rendered this experiment practically abortive. Owing to the higher yield produced by the 4 ft. by 2 ft. over the closer distances tried in the early experiments at the Farm, this distance had been fixed upon as the most suitable for Kibos, but the vigorous growth which the plants made on favourable years rendered free movement of the pickers up and down the rows at picking time without breaking the laterals an impossible matter. This, therefore, emphasises the need for continuing these distance trials.

The duration of this crop was nine months and twelve days, during which it received three weedings. The yield was somewhat below that obtained in previous years.

It is interesting to note that there has been a gradual falling off in the yield of cotton at the farm during the past three years. This is attributed to the loss of the Sunflower variety, which gave a yield of about 100 lbs. of seed cotton more per acre than either of the varieties supplied by the East African Corporation latterly. This fact further emphasises the need, so long felt and frequently referred to in previous reports, for establishing a careful system of seed selection, not merely for Kibos, but for the whole of those parts of the Province in which the industry is now being so extensively pushed.

The following is a table of results:—

Variety.	Area.	Planted.	Reaped.	Average Yield per acre.
Bukedi	10	April to June.	November to January.	500 lbs.

Groundnuts.—After being left out of the farm experiments for three seasons, Groundnuts were again included this season as a catch crop. Mindful of the Government Entomologist's opinion that the disease which killed this industry amongst the natives and caused the crop to be left out of the Farm's experiments on the preceding seasons was most likely introduced through the seed, great care was exercised in the choice of seed this season, which was obtained from a crop grown and matured in the district without showing signs of any disease. Three acres planted at the beginning of May, two acres as a crop between the rows of plants in the Fruit Plot, and one acre in the Timber Plot. Germination and early growth in both cases were good, but owing to the rapid growth of the young trees in the Eucalyptus Plot, which shaded the rows and robbed the young plants of the light so necessary to the development, this part of the experiment gave very poor results. In the wider spaces of the Fruit Plot, however, the plants did much better, giving an average yield of 950 lbs. of shelled nuts per acre.

The shelling of the nuts by hand would, perhaps, be too costly a business, but with the use of machines for this purpose groundnuts would perhaps prove the best catch crop grown, especially along the hillside in districts where conditions similar to those at Kibos prevail.

The following is a table of results:—

Variety.	Area in Acres.	Planted.	Reaped.	Average Yield per acre.
Local Shirate	3	May 6th	Aug. 28th	700 lbs.

Linseed.—An acre each with the three following varieties was tried as a catch crop.

- (1) Ceylon dwarf brown.
- (2) Ceylon dwarf white.
- (3) Riga Russian brown variety.

Planting was carried out at the commencement of the rains in March, and good growth was made by each of the varieties up to the fruiting stage, when a fungus disease, brought on no doubt by the excessive damp conditions, made its appearance, and in a very short time had taken possession of the plants to such an extent that their destruction by fire before the crop could be reaped became advisable.

Maize.—This experiment also suffered from the somewhat abnormal weather conditions which prevailed during the early part of the long rainy season.

The immediate cause of the damage done was standing water in the fields. Few cultivated crops become so quickly affected thereby, and on the flat lands at Kibos this common trouble is responsible for considerable loss on years similar to the present one. Two varieties were included in this experiment, *viz*:—Hickory King (white), planted early in March, and Hogan Yellow in the middle of April. The Hogan variety again showed its superior qualities over Hickory King, both as regards growth and yield.

The demand for Yellow Maizes locally is very small, and the quotations for the pure bred yellow varieties like Hogan are somewhat below those for Hickory King, but when the superior field qualities of Hogan (especially yield) over Hickory King are considered, growers engaged in the export business in districts similar to Kibos would do well to put under an equal acreage with each and compare results.

Two distances were tried in planting the Hickory King variety, *viz*:—3 ft. 6 ins. by 1 ft. 9 ins, and 4 ft. by 2 ft., but for reasons already mentioned this part of the experiment had not a fair chance.

The following is a table of results :—

Variety.	Area Acres.	Planted.	Reaped.	Average Yield per acre.
Hickory King ...	5	April 20th	Aug. 4th	840 lbs.
Hogan ...	5	May 8th	Aug. 10th	2,200 lbs.

Upland or Mountain Rice.—Two acres were planted with this crop at the beginning of March and gave most satisfactory results. Before planting, the soil was carefully prepared, having been ploughed and cross ploughed twice, and kept constantly cultivated so as to reduce it to a fine tilth, a condition necessary for the quick growth of the young plants. The seed was sown in drills, each drill being three feet apart, and as soon as the seedlings had developed a suitable size, from 6 to 9 inches in height, a portion of them was removed in each line in bunches of three to four each and planted in the centre of the space between the rows, 18 inches apart, thus establishing a stand of 18 inches apart all round. This method proved very successful.

Although the Upland varieties are, generally speaking, inferior in quality to the Lowland varieties, there are some of the former, and that experimented this season is one, which, both as regard size of grains and general table qualities, compare very favourably with the latter.

The following is a table of results :—

Variety.	Area.	Planted.	Reaped.	Average Yield per acre.
Gumpty	2	March 6th	Sept. 10th	1,100 lbs.

Sim Sim.—In common with crops planted during the short rains throughout the districts, this experiment resulted in a complete failure owing to the drought.

Uba Sugar Cane.—Fifteen plants of the above were received from the Head Office, Nairobi, in September. These were planted in a suitable place in the Fruit Plot. A 4 feet wide trench was opened to a depth of 18 inches, and afterwards filled nearly to the top with good top soil, the plants, which averaged 3 feet in length, being laid lengthways across the trench, 6 feet apart, and covered to a depth of 4 inches with good soil. Owing to the drought which set in shortly after planting, frequent watering had to be carried out until the plants had rooted well. At the time of writing, nine months from date of planting, the six clumps of plants which grew average a height of 7 feet.

The Uba is a small variety of sugar cane with a high sugar content and good drought resisting qualities, which should make it specially suited to the conditions at Kibos.

Tobacco.—This was a catch crop experiment conducted in conjunction with coffee with the three following varieties:—

- (1) White Burley,
- (2) Flannagan,
- (3) Bullion.

Seed was sown in nursery beds at intervals of a fortnight in the month of February. Germination was good, and in from six to eight weeks from date of sowing the young seedlings were transplanted to the fields.

Judged from appearance, the average soil found on the farm at Kibos would, perhaps, be considered by even experienced growers to be unsuited for growing any but the heavier kinds of tobacco. Experiments have, however, shown that when land which had been under frequent previous cultivation is used the contrary is the case.

The plot used in this experiment was a good example of this. The three varieties made equally good growth, though White Burley was more rapid and earlier maturing, the harvesting of this commencing three months from date of transplanting, as against four to five months for the other two.

The curing of the plants was carried out by what is known as the slow and gradual process in an ordinary mud and grass house. Owing to the leaking of the roof, and during prolonged periods of wet weather, much trouble was experienced from mould and "wet leaf," but these were kept in check fairly successfully by the judicious use of charcoal fires.

The following is a table of results:—

Variety.	Area Acres.	Planted.	Reaped.	Average Yield per acre.
White Burley ...	1	Mar. 15th	July & Aug.	410 lbs.
Blannagan ...	$\frac{3}{4}$	Mar. 17th	Aug. & Sep.	312 lbs.
Fullion ...	$\frac{3}{4}$	Mar. 28th	September	330 lbs.

PERMANENT CROPS.

Coffee.—In recent years this experiment has perhaps been the centre of attraction to the Farm. Prominent among the long list of visitors attracted thereto was a goodly number of the Muhoroni settlers, who were struck by the profuse manner in which the older trees were bearing. Carrying, as it does, plants in various stages of growth, from one to seven years, this plot offers splendid facilities for demonstrating the possibilities for Coffee in Kibos and similar districts.

The recent visit of the Coffee Expert, Mr. le Poer Trench, was especially welcome, coming as it did at a time when the demonstration by him of the methods of pruning best suited to what he described as typical lowland coffee could be conveniently undertaken.

The grubbing of the plants in the old adjoining sisal plot is proceeding. When completed this will be planted with Banana Shade, and a series of distance experiments started with coffee from plants being raised in the nursery for the purpose.

Cocoa.—A number of plants were raised in the nursery in banana pots from four pods supplied by the Chief of the Economic Plants Division, who obtained these on the occasion of his visit to Uganda from the Botanic Gardens at Entebbe. Holes have been opened for the reception of the plants, which will be put out as soon as they have developed a suitable size.

FRUIT TREES.

Citrus.—All the members of this family of plants, including Limes, Lemons, and various kinds of Oranges planted in the Fruit Plot made equally good progress during the year. The last-named include 16 plants of imported varieties, four of which fruited for the first time during the year. Both as regards growth and fruiting, these plants are easily first among those in the Fruit Plot, and the demand for plants continues to increase.

Mangos.—The three old trees planted near the compound again produced a small crop of fruits. Although these trees have flowered freely and the quality of their fruits has always been good, the crops produced so far by them have always been small. The three eucalyptus trees near which they were growing were cut out by their roots, and it is hoped that by thus admitting more light to the plants their bearing powers will improve.

Coconuts.—The four eight-year-old trees which commenced flowering the previous year have so far failed to mature any of their fruits. As these latter were larger and larger at each shedding there seems every reason to expect that some of those remaining on the trees at present will reach maturity. The three-year-old plants made fair progress under the circumstances, and a further lot of young plants is being raised for planting in the Lake Shore district, where the soil conditions are more suitable.

Papaws.—There has been a marked deterioration in the size, though the quality of the fruits of the Giant Papaws has continued excellent. Large numbers of young plants of this variety were raised and distributed in the district.

Pineapple.—Both as regards size and quality of fruits, the smooth Cayenne variety continued to maintain first place in the Pinery, which was extended by the addition of three more beds 20 feet long by 12 feet wide. The demand for suckers of the smooth Cayenne variety continues to increase, and in order to meet this a further extension is proposed by taking in the adjoining half-acre of land from which the old sisal plants are being rooted out.

Other Fruits. These include Guavas, Pommegranate, Cashew, and Jack Fruit. The two first-mentioned produced fruit. The two latter made rather slow, but healthy growth.

Labour.—The supply of voluntary labour was not nearly so plentiful as in past years. During the year the rate of wages for ordinary labourers was raised from Rs. 4 to Rs. 5 per month.

Live Stock.—The condition of these has been satisfactory. Towards the end of the year an addition of eight working oxen was made, raising the working strength of these on the Farm to sixteen.

Visitors.—The number of visitors to the Farm during the year showed a great increase on previous years, and includes a long list of settlers from the Muhoroni district.

The various visits paid by Government and Department Officers included those of the late Acting Provincial Commissioner, the Chief of the Economic Plants Division, the Tobacco Expert, and the Coffee Expert.

Plants and Seed Distribution. That the value of the farm as a distributing centre for the more important of the Economic Plants, Seeds, etc., suitable for growing in the districts with which this report deals is being more and more recognised may be seen from the number of applications received for such seeds, plants, etc.

These have steadily increased during the past three years, and often the supply has been below the demand.

The following is a list of the more important of these, which have either been sold or distributed gratis during the year:—

Banana Suckers	...	...	360	
Cane Plants	...	...	1,500	
Lime Plants	...	...	175	
Lemon Plants	...	...	375	
Coffee Plants	...	...	1,000	
Giant Papaw Plants	...	...	310	
Upland Rice Seed	...	...		375 lbs.
Chillie Seed	...	...		30 lbs.
Swamp Rice Seed	...	...		120 lbs.
Total	...	3,720	525 lbs.	

Agricultural Instruction.—This branch of work received the usual close attention. Itinerant tours were undertaken in the Kisumu and Mumias districts as heretofore in connection with agricultural matters generally, though this year special attention was paid to the cotton and rice industries. With regard to the cotton industry the results were far in advance of those of previous years. This was largely due to the appointment of two native assistants for inspection work. These facilities rendered the closer supervision of large areas over which seed was distributed in previous years, but from which no return was produced and how far the industry has been affected thereby may be judged from the fact that, from the same quantity of seed distributed, the output increased from 200,000 lbs. of seed cotton on the previous year to well over 500,000 lbs. during the present year.

With regard to rice cultivation, this was undertaken towards the end of the cotton season, and the work at the commencement confined to the various Chiefs and their Headmen in the Mumias district, who readily fell in with the idea of clearing and draining the swamps for cultivation.

Indeed, this idea so happily conceived by the then District Commissioner, Mr. Horne, and since being vigorously pushed by the present District Commissioner, Mr. Campbell, promises to revolutionise the agricultural prospects of the districts affected thereby. At the end of the cotton season I spent much of my time advising the natives on matters of drainage irrigation, several hundred acres, which only represented a small proportion of the area actually taken in hand, being dealt with. Besides rice, such crops as bananas, beans, and maize are also being planted in suitable parts of these drained swamps by natives.

Altogether steady progress is being made in the Native Agricultural Instruction work in the districts to which the report refers.

I have the honour to be,

Sir,

Your obedient servant,

(Signed) H. H. HOLDER,

Plant Instructor.

ANNUAL REPORT

ON THE
GOVERNMENT FARM, MAZERAS,
FOR THE
YEAR ENDING 31ST MARCH, 1914.

THE HONOURABLE
THE DIRECTOR OF AGRICULTURE,
Agricultural Department, Nairobi.

SIR,

I have the honour to submit the sixth annual report on the Government Farm, Mazeras, for the year ending the 31st of March, 1914, together with a report of my work in connection with the establishing of beetle traps, and the destruction of the Coconut Beetle for the same period.

Weather.—The rainfall for the period was 32.14 inches. Rain fell on 90 days during the year, and the greatest fall was 2.06 inches on the 20th of May.

This rainfall is the lowest on record since the inauguration of the Farm, and various experimental crops suffered severely, in common with other crops in the surrounding districts, as a result of the very irregular manner in which it was distributed over both planting seasons.

Monthly Rainfall—1913-1914.

Month,		No. of days Rain.	Inches.	Greatest fall,	Date,
April	1913 ...	14	7.15	2.22	29th
May	" ...	19	9.38	2.06	20th
June	" ...	10	1.96	0.76	13th
July	" ...	6	1.31	0.68	6th
August	" ...	8	1.97	0.62	31st
September	" ...	6	3.20	1.79	8th
October	" ...	9	2.48	0.60	25th
November	" ...	4	0.36	0.16	16th
December	" ...	1	0.04	0.04	29th
January	1914 ...	8	2.51	0.91	4th
February	" ...	1	0.56	0.56	14th
March	" ...	4	1.22	0.45	28th

Annual Rainfall Return for Six Years.

Period.	Quantity in inches.	Month of Greatest fall.	Quantity in inches.
1908—1909 ...	50.61	May	18.41
1909—1910 ...	65.69	October	13.27
1910—1911 ...	32.73	May	8.14
1911—1912 ...	44.58	May	9.51
1912—1913 ...	37.47	April	9.39
1913—1914 ...	32.14	May	9.38

Staff.—Several visits of inspection were paid by the Hon. the Director of Agriculture and by the Chief of the Economic Plants Division, and their instructions have been duly carried out.

Acting on the instructions of the Honourable the Director of Agriculture, the Plant Instructor, in conjunction with his duties at the farm, was also detailed for service in connection with the establishing of beetle traps for the destruction of the Coconut Beetle, and the cutting down of dead and diseased coconut trees. Otherwise the staff remained unchanged.

Labour.—This has not been so satisfactory as in the past, and may be due to the reported high wages obtained by labourers at Kilindini and elsewhere.

Owing to the erection of buildings, the opening of new shambas, and the construction of works of various kinds along the coast, particularly in the vicinity of Mombasa, Kilindini, and Mazaras, labour is very difficult to obtain.

Labourers who recently were glad to obtain Rs. 10 per month minus posho will not now accept less than Rs. 10 to Rs. 12 with posho.

However, in spite of the above, our supply was fair, and the amount expended on labour in connection with the farm was considerably less than in any previous year.

Drains.—In addition to those already existing a number of open drains were made, especially along the new road which leads from the *Acalypha* hedge on the railway side of the farm to the dwelling house.

Repairs have also been given to stone culverts where necessary.

Water Supply.—During the prolonged drought water was applied daily to a number of valuable plants in order to preserve them from perishing.

Insect Pests.—No serious outbreak of insect or other pest occurred, and all pests which were observed were, by spraying and other means, effectively controlled.

Experiments.—The experiments which were conducted during the period under review consisted of such crops as rice, beans, maize and sim sim only, but the weather conditions were so very unfavourable as to render the result most unsatisfactory.

Nurseries.—Applications for plants, economic and ornamental, being on the increase, it was found necessary to instruct and teach a few of the elder boys in service in the best way of preparing beds, lifting rooted plants, making cuttings, sowing various kinds of seeds, and raising plants generally.

The importance and utility of this branch of work cannot be over-estimated, and is of great advantage, and will correspondingly be extended with the increased demands for propagated plants.

Apart from general routine work, it teaches the native to think out for himself the value of knowing how best to raise plants, and also to inculcate and adopt the best methods of raising crops, other than those to which he has long been accustomed.

Distribution of Plants.—An important feature of the work carried out during the year, in spite of the prolonged drought prevalent, was the propagation and distribution of plants, as will be seen from the following lists:—

DISTRIBUTIONS "FREE."

Arrowroot plants	...	...	1,000
Banana plants (imported)	...	...	96
Banana plants (ordinary)	...	...	...
Banana fruit (bunches)	...	...	...
Bamboo plants (assorted)	...	...	12
Creepers	...	...	6
Cuttings, various kinds	...	...	5,800
Hedge, seeds and plants	...	...	...
Logwood seeds	...	...	...
Ornamental plants various kinds	...	...	3,501
Papaw seeds (giant)	...	...	...
Palms	...	...	8
Pine plants (imported kinds)	...	...	122
Pine plants (ordinary kinds)	...	...	52
Pineapples (imported kinds)	...	...	48
Pineapples (ordinary kinds)	...	...	...
Papaw fruit (giant)	...	...	72
Shade trees	...	...	30
Shade trees, seeds	...	...	...
Seeds, economic plants	...	...	...

DISTRIBUTIONS, "SALES."

Arrowroot plants	...	...	10,000
Bamboo plants (assorted)	...	...	22
Bamboo rods	...	...	150
Banana plants (imported)	...	...	233
Banana plants (ordinary)	...	...	50
Banana bunches (imported)	...	...	152
Banana bunches (ordinary)	...	...	460
Cuttings	...	...	...
Ginger	...	...	...
Hedge plants and seeds	...	...	...
Logwood seeds	...	...	...
Ornamental plants and shrubs	...	...	500
Pineapples (imported kinds)	...	...	610
Pineapples (ordinary kinds)	...	...	281
Pine plants (imported kinds)	...	...	229
Pine plants (ordinary kinds)	...	...	482
Papaw seeds (giant)	...	...	...
Papaw fruit (giant)	...	...	858
Rubber seeds	...	...	2 lbs.
Rubber plants	...	...	...
Sisal plants	...	...	500
Sisal poles	...	...	52
Shade trees	...	...	...
Sugar cane plants	...	...	5,081

Contributions.—Much indebtedness is again due to those persons who so very kindly assisted by contributing plants and seeds.

Visitors.—The farm still continues to be of considerable interest and attraction to planters and other residents in the Protectorate.

Apart from the usefulness of this institution as a producing and distributing centre for fruit, seeds and plants, of ornamental and also of an economic value, oversea visitors and various classes of residents in Mombasa and elsewhere continue to regard the farm as a place of resort by availing themselves of the facilities provided by the recently increased daily service of trains to and from Mazaras.

Correspondence.—Apart from the usual amount of official correspondence, a number of letters was received from persons requesting information with regard to various crops.

General Farm Cultivations.

ARROWROOT (ST. VINCENT) *Maranta Arrowdinacea*.—This plot continued to be of very satisfactory growth, and to be free from the attacks of pests.

A few thousand plants have been distributed to planters in different localities, who, it would appear, are desirous of undertaking its cultivation with a view of establishing this industry on a somewhat large scale in the Protectorate.

ANATTO DYE (*Bixa Orellana*).—These plants continue to be of vigorous growth. A supply of seeds is available, but there is apparently no demand.

BAMBOOS (*Bambusa Spp*).—These plants are doing well and have kept wonderfully free from scale insects. A number of them may be seen growing luxuriantly along the railway side of the farm.

There is a demand for plants of the yellow and giant varieties, and a few plants have been distributed.

BANANA (*Musa Spp*).—The demand for fruit and plants of the imported kinds of banana continues. The varieties already established are doing well, and plants from them have been distributed.

BREADFRUIT (*Arlocarpus Incisa*).—These plants were introduced from Ceylon, and are of vigorous growth, and have all fruited.

CITRUS FRUIT (*Citrus Aurantium Spp*).—Such plants as are established include limes, lemons and oranges, and have all done well.

A few of the budded varieties of oranges have fruited this year for the first time, and all the limes and different varieties of local oranges have also fruited.

There is a great and growing demand among the settlers, and others, for plants of good varieties of oranges, and in order to meet the demand hundreds of lemon seedlings were raised to serve as stocks for budding purposes.

It is to be hoped that supplies of budded oranges and other good varieties of citrus fruits will be available in the near future.

COCOA (*Theobroma Cacao*).—These plants have not done so well. The younger plants suffered somewhat severely, partly owing to drought, and as a result of a disastrous fire which swept across the plot from adjoining fields cultivated by natives.

A few of the plants in this plot flowered.

A consignment of seeds was received from the Manager, Nairobi Forests, and these have been sown, and the plants raised from them will be utilised in filling up vacancies in the plot.

COCONUT (*Cocos Nucifera*).—The plants established on the farm are doing well, and many of the older trees have fruited.

On the 27th of June a consignment of 500 selected seed nuts was received from the industrial station of the United Methodists' Mission at Ribe.

These have been planted in specially prepared nurseries, and have germinated well.

It is intended to plant them on a portion of land newly added to the farm on the hill side. This land (about 15 acres in extent) has been cleared and lined, and planted with banana plants to serve as temporary shade to protect the young coconut seedlings, which will be planted at 30 feet apart.

HEDGES (various kinds).—Special attention was given to the various kinds of hedges established on the farm, and in addition to those already existing two new hedges, one of logwood and the other of pomegranate, have been planted along the new road which leads to the dwelling-house from the railway side of the farm.

LOGWOOD (*Hæmatoxylon Compectianum*).—These plants continue to be of excellent growth. Seeds collected from them have been distributed, and a great number of seedlings have been raised.

MANILLA HEMP (*Musa Textilis*).—There is practically no demand for young plants, hundreds of which are ready for distribution.

The older plants continue to maintain good growth.

PAPAW GIANT (*Carica Papaya*).—The fruit of this giant papaw is much in demand, and several hundreds of them have been sold.

A fairly good number of papaw seeds have also been distributed.

PINEAPPLE (*Ananas Sativa*).—The demand for plants and fruit of the exotic varieties of pineapples is greatly on the increase, and many plants have been distributed.

Upwards of 5,000 additional pine plants have been planted out, and of this number 3,000 are imported kinds.

RUBBER (several varieties).—As will be seen from the list of distributions, there is no demand for rubber seeds or plants.

The plants of the different varieties of rubber on the farm are of healthy and vigorous growth.

SISAL (*Agave Regida* Var *Sisalana*).—The natives in the district make frequent use of the dry sisal poles as rafters in the construction of the roofs of their houses, and have bought poles from the farm for this purpose.

SUGAR CANE (*Sæcharum Officinarum*).—Over 5,000 plants have been distributed from this plot.

Plants were also selected for the planting of a new plot, and the old plot was subsequently discarded.

MISCELLANEOUS PLANTS.—It is encouraging to note that a great many of the ornamental foliage plants and flowering shrubs and shade trees which have been propagated have either been planted out on the farm or sent to the Public Gardens at Mombasa, and Government House grounds at Mombasa.

I have the honour to be,

Sir,

Your most obedient servant,

(Signed) J. B. DOPWELL,

Plant Instructor.

ANNUAL REPORT

ON THE

ENTOMOLOGICAL LABORATORY

FOR THE

YEAR ENDING 31ST MARCH, 1914.

ENTOMOLOGICAL LABORATORY,

KABETE, *May*, 1914.

THE HONOURABLE,

THE DIRECTOR OF AGRICULTURE.

SIR,

I have the honour to submit herewith my report for the year ending 31st March, 1914.

Roland H. Deakin, M.Sc., was appointed Assistant Entomologist in June, and began work here on the 7th of August, 1913. Since his arrival the greater part of his time has been occupied in the study of insect pests on citrus and wattle. When further information has been obtained bulletins will be published on the subjects.

Mr. H. B. Sharpe has been appointed Plant Import Inspector in place of Mr. Barlow, who resigned. Mr. Sharpe took over from Mr. Barlow on the 1st of December.

Plant Import and Inspection.

Consignments to the number of 1,240, valued at Rs. 65,224, were passed for entry into the Protectorate.

Thirteen consignments, valued at approximately Rs. 800, were confiscated.

In transit for Uganda, the Belgian Congo and German East Africa, 192 packages, valued at Rs. 9,342, were passed. These included coffee berries, which were sealed upon entry into this Protectorate.

7,050 tons of maize were passed for export, 70 tons were fumigated, and 40 tons condemned as being unfit for export.

Details of these imports and exports will be found in the report of the Plant Import Inspector, a copy of which is attached.

The Coconut Palm.

THE COCONUT BEETLE.—The coconut beetle—*Oryctes monoceros*, Olivier—is the worst enemy of the coconut palm on the coast of British East Africa. It is found in every plantation, though the damage is more noticeable in some districts than in others.

On July 22nd an experiment in the control of the beetle was begun. Artificial breeding places or ‘traps’ were constructed which could be examined periodically. A trap consists of a heap of decaying vegetable matter to which the beetles are attracted for egg-laying. A hole is dug in the ground about nine feet square and about eighteen inches deep; this is filled with parts of the stems of palms and other vegetable matter.

The beetle prefers damp decaying vegetable matter as a breeding place, but for many of the traps it was not possible to obtain such material, and the trap was constructed of parts of palms which, though dead, had not begun to decay. In other places the material obtainable was too dry. Such traps, after being soaked by several showers of rain, and when the contents have begun to decay, will be found to be just as effective as traps made under the most favourable circumstances.

In all, 288 traps have been constructed in the Changamwe, Rabai and Freretown districts. A start was made at Changamwe station, which is situated in an area thickly planted with coconuts, and is within access of Mombasa. A series of traps was made, about 220 yards apart, along both sides of the railway.

For the construction of these 288 traps, 1,204 dead palms were split up. Of these 812 were standing dead palms, and 392 were lying on the ground.

When these palms were broken up, the beetles, pupae, larvae, and eggs found were collected, counted and destroyed. A detailed list of the counts from the first 1,000 palms cut is attached. If there had been any doubt before, this list shows that both standing and fallen dead palms are the breeding places of the beetle, and that the destruction of such dead palms is essential.

From the figures obtained it has been calculated that the average number of beetles in a standing dead palm is	7,
grubs in a standing dead palm ...	4,
beetles in a fallen palm ...	23,
grubs in a fallen palm ...	49.

Four and a half to five months after construction the traps are opened and the beetles, etc., collected, counted and destroyed. Up to date the first 186 of the traps have been opened, examined and remade. A list of the beetles, etc., found is attached.

Each trap is labelled with the date of construction and dates of openings, and a map on a large scale is being prepared showing the position of each trap.

It is not my intention to construct more traps at present, but to experiment with those already made. These will be opened at regular intervals to determine, amongst other things, if the traps become more effective with age and if the traps are more effective in districts where other breeding places are done away with, *i.e.*, where all dead palms and heaps of decaying vegetable matter are destroyed and the plantations properly cultivated.

Until proper supervision is arranged for it is not proposed to advise native plantation owners to construct traps. Unless opened, etc., at the proper times, a trap is simply breeding beetles for the neighbourhood. Although he may promise, even the better class Swahili cannot be trusted to do the work properly, and for the present the only traps made will be under Government supervision, or on plantations owned by Europeans.

It has been calculated by Mr. Dopwell, who was in charge at the time, that each trap costs Rs. 1/98 to construct. This is irrespective of posho and transport.

Fumigating of the traps with carbon bisulphide was tried, but before giving definite figures I intend to repeat the experiments in several districts.

Dr. Friedrichs, Government Entomologist, Samoa, has recently discovered a fungus, indigenous to Samoa, which attacks the larvæ of the beetle, causing death. It was found that traps constructed in a somewhat similar manner to those described could be infected with artificial cultures of this fungus. As far as can be ascertained, it would appear that this method of control has been very effective. An endeavour is being made to introduce this fungus, and to test its efficacy here.

SCALE INSECTS.—Specimens of Scale Insects (*Aspidiotus sp.*) were received from Mr. R. N. Ashton, Manager, Glenarne (Mombasa) Rubber Coy. These were reported to be doing considerable damage to young palms. A rosin and washing soda spray was suggested, and was tried by Mr. Ashton. In one of his letters he states: "The No. 1 spray which you suggested has so far been satisfactory. Out of four rows of trees treated there are only 19 which show any trace of the Scale Pest. Nineteen out of a possible 360 are very good."

COCONUT BEETLE. CUTTING OF DEAD PALMS.

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae	Larvae.	Egges.	No. of trap.
1.	Standing	22. 7.13	Changamwe	9	...	35	..	..
2.	Fallen	"	"	3	...	17	..	...
3.	Fallen	"	"	7	...	65	..	...
4.	Standing	"	"	1	...	6	..	...
5.	Fallen	"	"	13	...	47	...	...
6.	Fallen	"	"	5	...	51	...	...
7.	Standing	23. 7.13	"	2	...	14	...	...
8.	Fallen	"	"	11	...	75	...	...
9.	Fallen	"	"	6	...	19	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
10.	Standing	23. 7.13	Changamwe	10	...	4	...	...
11.	Fallen	"	"	8	...	26	...	...
12.	Fallen	"	"	14	...	54	...	...
13.	Standing	24. 7.13	"	9	...	...	...	...
14.	Fallen	"	"	3	...	21	...	...
15.	Fallen	"	"	17	...	95	...	...
16.	Standing	"	"	...	...	...	...	...
17.	Fallen	"	"	4	...	20	...	...
18.	Fallen	"	"	7	...	33	...	...
19.	Standing	25. 7.13	"	2	...	18	...	...
20.	Fallen	"	"	16	...	24	...	...
21.	Fallen	"	"	8	...	13	...	...
22.	Standing	"	"	5	...	18	...	...
23.	Fallen	"	"	12	...	46	...	...
24.	Fallen	"	"	4	...	23	...	...
25.	Standing	26. 7.13	"	...	...	7	...	...
26.	Fallen	"	"	14	...	39	...	...
27.	Fallen	"	"	7	...	51	...	...
28.	Standing	"	"	6	...	97	...	...
29.	Fallen	"	"	12	...	59	...	...
30.	Fallen	"	"	17	...	113	...	...
31.	Standing	28. 7.13	"	2	...	...	...	...
32.	Fallen	"	"	5	...	17	...	...
33.	Fallen	"	"	11	...	82	...	...
34.	Standing	"	"	4	...	46	...	...
35.	Fallen	"	"	15	...	76	...	...
36.	Fallen	"	"	10	...	53	...	...
37.	Standing	29. 7.13	"	1	...	19	...	...
38.	Fallen	"	"	5	...	23	...	...
39.	Fallen	"	"	14	...	83	...	...
40.	Standing	"	"	4	...	...	...	...
41.	Fallen	"	"	...	...	27	...	...
42.	Fallen	"	"	6	...	18	...	...
43.	Standing	30. 7.13	"	2	...	...	...	...
44.	Fallen	"	"	21	...	74	...	...
45.	Fallen	"	"	8	...	81	...	...
46.	Standing	"	"	7	...	...	...	...
47.	Fallen	"	"	...	...	43	...	...
48.	Fallen	"	"	10	...	26	...	...
49.	Standing	31. 7.13	"	14	...	...	...	...
50.	Fallen	"	"	10	...	39	...	...
51.	Fallen	"	"	22	...	87	...	...
52.	Standing	"	"	1	...	...	...	...
53.	Fallen	"	"	...	...	63	...	...
54.	Fallen	"	"	17	...	98	...	...
55.	Standing	1. 8.13	Jonvu	4	...	18	...	...
56.	Fallen	"	"	9	...	73	...	...
57.	Fallen	"	"	11	...	41	...	...
58.	Standing	"	"	9	...	58	...	...
59.	Fallen	"	"	6	...	36	...	...
60.	Fallen	"	"	18	...	79	...	...
61.	Standing	2. 8.13	"	14	...	18	...	...
62.	Fallen	"	"	17	...	54	...	...
63.	Fallen	"	"	5	...	21	...	...
64.	Standing	"	"	8	...	...	...	...
65.	Fallen	"	"	...	...	...	...	...
66.	Fallen	"	"	13	...	73	...	...
67.	Standing	4. 8.13	Changamwe	6	...	...	...	...
68.	Standing	"	"	18	...	27	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
69.	Standing	4. 8 15	Changamwe	7	...	...	...	...
70.	Fallen	"	"	23	...	86	5	...
71.	Standing	"	"	14	...	43	...	...
72.	Standing	"	"	...	...	...	...	...
73.	Standing	"	"	3	...	...	...	...
74.	Standing	"	"	13	...	...	...	...
75.	Standing	"	"	6	...	18	...	...
76.	Standing	6/7. 6.13	"	1	...	...	...	...
77.	Fallen	"	"	44	...	98	18	...
78.	Fallen	"	"	5	...	57	...	...
79.	Standing	"	"	12	...	7	...	...
80.	Fallen	"	"	6	...	83	...	...
81.	Fallen	"	"	...	...	14	...	...
82.	Fallen	"	"	34	...	98	3	...
83.	Standing	"	"	4	...	...	...	...
84.	Standing	"	"	17	...	...	...	...
85.	Standing	8. 8.13	"	...	...	...	...	...
86.	Standing	"	"	3	...	...	...	...
87.	Standing	"	"	9	...	22	...	...
88.	Fallen	11. 8.13	"	15	...	71	...	...
89.	Fallen	"	"	40	...	19	...	...
90.	Standing	"	"	12	...	...	...	...
91.	Standing	"	"	7	...	3	...	...
92.	Fallen	"	"	51	...	42	7	...
93.	Standing	"	"	...	...	...	...	...
94.	Standing	12/13. 8.13	Jomvu	4	...	...	...	...
95.	Standing	"	"	18	...	...	...	...
96.	Fallen	"	"	6	...	15	...	...
97.	Standing	"	"	...	...	...	...	...
98.	Fallen	"	"	...	...	29	...	...
99.	Fallen	"	"	13	...	31	...	...
100.	Fallen	"	"	8	...	76	15	...
101.	Standing	"	"	...	...	...	...	...
102.	Fallen	"	"	...	...	6	...	...
103.	Fallen	14. 8.13	"	5	...	...	...	...
104.	Standing	"	"	2	...	...	...	...
105.	Fallen	"	"	11	...	19	...	...
106.	Fallen	15. 8.13	"	23	...	78	...	...
107.	Fallen	"	"	5	...	30	...	...
108.	Standing	"	"	1	...	...	...	...
109.	Standing	16. 8.13	"	...	...	...	...	...
110.	Fallen	"	"	4	...	15	...	...
111.	Standing	"	"	6	...	...	...	...
112.	Fallen	18. 8.13	"	24	...	87	20	...
113.	Standing	"	"	10	...	...	...	...
114.	Standing	"	"	4	...	17	...	...
115.	Fallen	19. 8.13	"	14	...	31	...	...
116.	Standing	"	"	...	...	...	...	...
117.	Standing	"	"	3	...	...	...	...
118.	Fallen	20. 8.13	"	18	...	65	40	...
119.	Fallen	"	"	1	...	...	...	...
120.	Standing	"	"	1	...	...	...	...
121.	Standing	21. 8.13	"	5	...	...	...	...
122.	Standing	"	"	...	...	...	...	...
123.	Standing	"	"	2	...	...	...	...
124.	Fallen	22. 8.13	"	...	...	8	...	...
125.	Standing	"	"	7	...	...	...	...
126.	Standing	"	"	...	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
127.	Standing	23. 8.13	Jomvn	4	...	...	...	...
128.	Standing	"	"	10	...	...	...	...
129.	Standing	"	"	2	...	...	...	...
130.	Standing	"	"	18	...	...	...	...
132.	Standing	"	"	...	...	...	...	...
133.	Fallen	25. 8.13	"	43	...	112	18	...
134.	Fallen	"	"	19	...	75	...	...
135.	Standing	"	"	...	...	...	...	...
136.	Standing	"	"	7	...	...	...	...
137.	Standing	"	"	1	...	...	...	...
138.	Standing	"	"	3	...	...	...	...
139.	Standing	26. 8.13	"	17	...	41	...	...
140.	Standing	"	"	8	...	...	...	...
141.	Fallen	"	"	72	...	136	15	...
142.	Fallen	"	"	31	...	82	...	...
143.	Standing	"	"	...	...	...	...	...
144.	Standing	"	"	2	...	...	...	...
145.	Standing	27. 8.13	"	15	...	...	...	...
146.	Standing	"	"	...	...	...	...	...
147.	Fallen	"	"	9	...	33	...	...
148.	Standing	"	"	5	...	...	...	...
149.	Standing	"	"	11	...	6	...	...
150.	Standing	"	"	...	...	...	...	...
151.	Standing	28. 8.13	"	16	...	...	...	...
152.	Standing	"	"	5	...	...	...	...
153.	Fallen	"	"	41	...	87	3	...
154.	Standing	"	"	12	...	23	...	...
155.	Standing	"	"	4	...	...	...	...
156.	Standing	"	"	17	...	...	...	...
157.	Standing	29. 8.13	"	21	...	...	...	...
158.	Standing	"	"	1	...	...	...	...
159.	Fallen	"	"	53	...	125	...	...
160.	Fallen	"	"	18	...	91	...	...
161.	Standing	"	"	...	...	...	...	...
162.	Fallen	"	"	11	...	58	...	...
163.	Standing	30. 8.13	"	3	...	...	...	...
164.	Standing	"	"	...	...	...	...	...
165.	Standing	"	"	7	...	...	...	...
166.	Fallen	"	"	14	...	82	...	...
167.	Fallen	"	"	37	...	151	...	...
168.	Standing	"	"	...	...	...	...	...
169.	Standing	1. 9.13	Miritini	12	...	...	...	...
170.	Standing	"	"	4	...	...	...	...
171.	Standing	"	"	17	...	8	...	...
172.	Fallen	"	"	41	...	125	...	...
173.	Standing	"	"	...	...	...	...	...
174.	Fallen	"	"	34	...	87	...	...
175.	Standing	4. 9.13	"	1	...	...	...	...
176.	Standing	"	"	7	...	...	...	...
177.	Standing	"	"	17	...	...	...	...
178.	Fallen	"	"	53	...	117	...	...
179.	Standing	"	"	8	...	...	...	...
180.	Standing	"	"	...	...	...	...	...
181.	Fallen	5. 9.13	"	27	...	19	...	...
182.	Fallen	"	"	41	...	73	...	...
183.	Standing	"	"	3	...	...	...	...
184.	Standing	"	"	...	...	...	...	...
185.	Fallen	"	"	13	...	...	...	...
186.	Standing	"	"	7	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
187.	Fallen	6. 9.13	Miritini	11	...	26	...	...
188.	Fallen	"	"	...	...	...	...	...
189.	Standing	"	"	...	...	...	...	...
190.	Fallen	"	"	10	...	76	...	...
191.	Standing	"	"	5	...	...	...	...
192.	Standing	"	"	...	...	...	...	...
193.	Standing	8. 9.13	"	27	...	...	...	...
194.	Standing	"	"	9	...	...	...	...
195.	Standing	"	"	15	...	...	...	...
196.	Fallen	"	"	21	...	79	...	...
197.	Fallen	"	"	37	...	92	16	...
198.	Standing	"	"	...	...	...	...	...
199.	Fallen	10. 9.13	"	19	...	71	...	...
200.	Standing	"	"	5	...	...	...	...
201.	Standing	"	"	14	...	...	...	...
202.	Standing	"	"	26	...	...	...	...
203.	Fallen	"	"	17	...	...	...	...
204.	Fallen	"	"	32	...	105	19	...
205.	Fallen	11. 9.13	"	43	...	73	...	...
206.	Standing	"	"	4	...	...	...	...
207.	Standing	"	"	10	...	...	...	...
208.	Standing	"	"	10	...	...	...	...
209.	Standing	"	"	...	...	...	...	...
210.	Fallen	"	"	13	...	...	...	...
211.	Fallen	12. 9.13	"	7	...	...	...	...
212.	Standing	"	"	15	...	...	...	...
213.	Fallen	"	"	46	...	83	...	...
214.	Standing	"	"	...	...	...	...	...
215.	Standing	"	"	3	...	...	...	...
216.	Standing	"	"	18	...	...	...	...
217.	Fallen	13. 9.13	"	39	...	...	...	...
218.	Standing	"	"	...	...	...	...	...
219.	Standing	"	"	4	...	...	...	...
220.	Standing	"	"	12	...	...	...	...
221.	Fallen	"	"	19	...	...	...	...
222.	Standing	"	"	7	...	...	...	...
223.	Standing	14. 9.13	Mazeras	18	...	...	...	...
224.	Standing	"	"	23	...	...	...	...
225.	Standing	"	"	5	...	11	...	...
226.	Standing	"	"	17	...	6	...	...
227.	Fallen	"	"	11	...	72	5	...
228.	Fallen	"	"	82	...	119	31	...
229.	Standing	15. 9.13	Rabai	21	...	18	...	...
230.	Standing	"	"	...	...	...	...	...
231.	Fallen	"	"	53	...	93	...	...
232.	Standing	"	"	3	...	...	...	...
233.	Standing	"	"	7	...	...	...	...
234.	Standing	"	"	7	...	...	...	...
235.	Standing	"	"	5	...	...	...	...
236.	Fallen	"	"	42	...	97	...	...
237.	Fallen	16. 9.13	"	15	...	83	...	...
238.	Fallen	"	"	61	...	10	...	...
239.	Standing	"	"	...	...	...	...	...
240.	Standing	"	"	4	...	...	...	...
241.	Standing	"	"	2	...	...	...	...
242.	Standing	"	"	13	...	...	...	...
243.	Standing	"	"	18	...	6	...	...
244.	Fallen	"	"	27	...	51	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
245.	Fallen	17. 9.13	Rabai	33	...	11	...	...
246.	Fallen	"	"	54	...	102	...	...
247.	Standing	"	"	10	...	...	...	...
248.	Standing	"	"	...	...	...	...	...
249.	Fallen	"	"	72	...	115	...	...
250.	Standing	"	"	4	...	...	...	...
251.	Standing	"	"	17	...	...	...	...
252.	Standing	"	"	10	...	...	...	...
253.	Standing	18. 9.13	"	26	...	...	...	...
254.	Standing	"	"	8	...	14	...	...
255.	Fallen	"	"	65	...	...	...	...
256.	Fallen	"	"	32	...	119	6	...
257.	Standing	"	"	15	...	...	...	...
258.	Standing	"	"	...	...	...	...	...
259.	Standing	"	"	4	...	...	...	...
260.	Standing	"	"	23	...	7	...	...
261.	Standing	19. 9.13	"	18	...	...	...	...
262.	Standing	"	"	7	...	...	...	...
263.	Standing	"	"	11	...	...	...	...
264.	Standing	"	"	9	...	...	...	...
265.	Fallen	"	"	58	...	97	...	...
266.	Fallen	"	"	43	...	19	...	...
267.	Fallen	"	"	21	...	54	...	...
268.	Standing	20. 9.13	"	...	...	...	...	...
269.	Standing	"	"	5	...	...	...	...
270.	Standing	"	"	14	...	...	...	...
271.	Standing	"	"	1	...	...	...	...
272.	Standing	"	"	...	...	6	...	...
273.	Standing	"	"	23	...	...	...	...
274.	Standing	"	"	2	...	...	...	...
275.	Fallen	22. 9.13	"	76	...	18	...	...
276.	Fallen	"	"	45	...	86	...	...
277.	Standing	"	"	10	...	...	...	...
278.	Standing	"	"	19	...	...	...	...
279.	Standing	"	"	23	...	...	...	...
280.	Standing	"	"	41	...	...	...	...
281.	Standing	"	"	5	...	...	...	...
282.	Fallen	"	"	18	...	7	...	...
283.	Standing	23. 9.13	"	...	...	...	...	...
284.	Fallen	"	"	15	...	...	...	...
285.	Fallen	"	"	82	...	118	14	...
286.	Standing	"	"	2	...	...	...	...
287.	Standing	"	"	8	...	...	...	...
288.	Standing	"	"	12	...	...	...	...
289.	Standing	"	"	4	...	...	...	...
290.	Fallen	"	"	...	...	...	...	...
291.	Standing	24. 9.13	"	14	...	...	...	...
292.	Standing	"	"	...	...	...	...	...
293.	Standing	"	"	23	...	...	...	...
294.	Fallen	"	"	19	...	43	...	...
295.	Fallen	"	"	51	...	101	...	...
296.	Standing	"	"	3	...	...	...	...
297.	Standing	"	"	...	...	...	...	...
298.	Standing	"	"	5	...	...	...	...
299.	Standing	25. 9.13	"	4	...	...	...	...
300.	Standing	"	"	12	...	...	...	...
301.	Standing	"	"	21	...	...	...	...
302.	Standing	"	"	18	...	...	...	...
303.	Standing	"	"	...	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
304.	Standing	25. 9.13	Rabai	5	...	17	...	...
305.	Fallen	"	"	53	...	109	21	...
306.	Fallen	"	"	31	...	18	...	...
307.	Fallen	26. 9.13	"	43	...	64	...	...
308.	Standing	"	"	19	...	8	...	...
309.	Standing	"	"	4	...	...	...	...
310.	Standing	"	"	17	...	...	...	...
311.	Standing	"	"	...	...	...	...	...
312.	Fallen	"	"	23	...	7	...	...
313.	Fallen	"	"	50	...	83	...	...
314.	Fallen	"	"	29	...	6	...	...
315.	Standing	27. 9.13	"	10	...	...	...	...
316.	Standing	"	"	15	...	...	...	...
317.	Standing	"	"	...	...	...	...	...
318.	Standing	"	"	6	...	...	...	...
319.	Standing	"	"	3	...	...	...	...
320.	Fallen	"	"	20	...	6	...	...
321.	Standing	27. 9.13	Rabai	1	...	...	...	...
322.	Standing	"	"	...	...	...	...	...
323.	Fallen	29. 9.13	"	21	...	73	...	...
324.	Standing	"	"	4	...	...	...	...
325.	Standing	"	"	10	...	...	...	...
326.	Standing	"	"	18	...	...	...	...
327.	Standing	"	"	2	...	...	...	...
328.	Fallen	"	"	36	...	84	...	...
329.	Fallen	"	"	51	...	119	17	...
330.	Fallen	"	"	13	...	...	...	...
331.	Standing	30. 9.13	"	5	...	...	...	...
332.	Standing	"	"	...	...	...	...	...
333.	Fallen	"	"	26	...	43	...	...
334.	Fallen	"	"	17	...	...	...	...
335.	Standing	"	"	...	...	...	...	...
336.	Standing	"	"	12	...	...	...	...
337.	Standing	"	"	15	...	7	...	...
338.	Standing	"	"	3	...	...	...	...
339.	Standing	1.10.13	"	7	...	...	...	...
340.	Standing	"	"	14	...	...	...	...
341.	Fallen	"	"	...	...	10	...	...
342.	Fallen	"	"	31	...	87	...	...
343.	Fallen	"	"	23	...	18	...	...
344.	Fallen	"	"	17	...	48	...	...
345.	Standing	"	"	...	...	...	...	...
346.	Standing	"	"	5	...	...	...	...
347.	Standing	2.10.13	"	10	...	...	...	...
348.	Standing	"	"	...	...	18	...	...
349.	Standing	"	"	...	...	...	...	...
350.	Standing	"	"	4	...	...	...	...
351.	Fallen	"	"	18	...	...	...	...
352.	Standing	"	"	13	...	...	...	...
353.	Standing	"	"	7	...	...	...	...
354.	Standing	"	"	9	...	...	...	...
355.	Fallen	3.10.13	"	45	...	121	11	...
356.	Standing	"	"	...	...	...	...	...
357.	Standing	"	"	17	...	...	...	...
358.	Standing	"	"	3	...	...	...	...
359.	Fallen	"	"	31	...	73	...	...
360.	Fallen	"	"	19	...	33	...	...
361.	Fallen	"	"	27	...	5	...	...
362.	Fallen	4.10.13	"	45	...	92	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
363.	Standing	4.10.13	Rabai	8	...	...	...	...
364.	Standing	"	"	15	...	...	...	...
365.	Standing	"	"	10	...	...	...	...
366.	Standing	"	"	...	...	...	...	...
367.	Fallen	"	"	17	...	...	...	...
368.	Fallen	"	"	22	...	51	...	...
369.	Standing	"	"	5	...	...	...	...
370.	Fallen	6.10.13	"	15	...	26	...	...
371.	Fallen	"	"	41	...	117	...	18
372.	Fallen	"	"	35	...	82	...	...
373.	Standing	"	"	5	...	...	...	...
374.	Standing	"	"	...	...	...	...	...
375.	Standing	"	"	3	...	...	...	...
376.	Standing	"	"	18	...	...	...	...
377.	Standing	"	"	7	...	3	...	...
378.	Fallen	7.10.13	"	...	...	18	...	...
379.	Standing	"	"	10	...	...	...	...
380.	Standing	"	"	19	...	...	...	...
381.	Standing	"	"	14	...	...	...	...
382.	Fallen	"	"	27	...	18	...	...
383.	Fallen	"	"	31	...	53	...	...
384.	Standing	"	"	...	...	...	...	...
385.	Standing	"	"	2	...	...	...	...
386.	Standing	8.10.13	"	17	...	...	...	...
387.	Standing	"	"	14	...	...	...	...
388.	Standing	"	"	...	...	...	...	...
389.	Standing	"	"	2	...	...	...	...
390.	Fallen	"	"	43	...	26	...	...
391.	Standing	"	"	8	...	...	...	...
392.	Standing	"	"	...	...	...	...	...
393.	Standing	"	"	5	...	...	...	...
394.	Standing	9.10.13	"	21	...	...	...	...
395.	Standing	"	"	18	...	...	...	...
396.	Standing	"	"	2	...	...	...	...
397.	Standing	"	"	...	...	7	...	...
398.	Standing	"	"	5	...	...	...	...
399.	Standing	"	"	9	...	...	...	...
400.	Fallen	"	"	15	...	...	...	...
401.	Fallen	"	"	31	...	18	...	...
402.	Fallen	"	"	49	...	108	15	...
403.	Standing	"	"	...	...	...	...	...
404.	Standing	"	"	4	...	...	...	...
405.	Fallen	"	"	8	...	27	...	...
406.	Fallen	"	"	18	...	...	...	...
407.	Fallen	"	"	51	...	132	25	...
408.	Standing	"	"	4	...	...	...	...
409.	Standing	"	"	7	...	...	...	...
410.	Standing	11.10.13	"	3	...	...	...	...
411.	Standing	"	"	10	...	...	...	...
412.	Standing	"	"	18	...	...	...	...
413.	Fallen	"	"	26	...	43	...	...
414.	Fallen	"	"	...	...	18	...	...
415.	Standing	"	"	15	...	...	...	...
416.	Standing	"	"	...	...	...	...	...
417.	Standing	"	"	10	...	...	...	...
418.	Fallen	13.10.13	Kisimani	36	...	91	...	...
419.	Fallen	"	"	11	...	47	...	...
420.	Standing	"	"	7	...	...	...	...
421.	Standing	"	"	10	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles	Pupae.	Larvae.	Eggs.	No. of tarp.
422.	Standing	13.10.13	Kisimani	18	...	23	...	...
423.	Standing	"	"	5	...	11	...	...
424.	Standing	"	"	21	...	...	...	...
425.	Standing	"	"	4	...	...	...	...
426.	Standing	14.10.13	"	8	...	...	...	...
427.	Standing	"	"	10	...	15	...	...
428.	Standing	"	"	2	...	...	...	...
429.	Fallen	"	"	4	...	...	...	...
430.	Fallen	"	"	43	...	118	21	...
431.	Fallen	"	"	21	...	17	...	...
432.	Fallen	"	"	...	...	8	...	...
433.	Standing	"	"	15	...	...	...	...
434.	Standing	15.10.13	"	19	...	6	...	...
435.	Standing	"	"	4	...	...	...	...
436.	Standing	"	"	5	...	...	...	...
437.	Fallen	"	"	11	...	...	...	...
438.	Fallen	"	"	42	...	73	...	...
439.	Fallen	"	"	18	...	...	...	...
440.	Standing	16.10.13	"	16	...	...	...	...
441.	Standing	"	"	9	...	...	...	...
442.	Standing	"	"	11	...	...	...	...
443.	Standing	"	"	7	...	...	...	...
444.	Standing	"	"	...	...	...	...	...
445.	Fallen	"	"	25	...	13	...	...
446.	Fallen	"	"	18	...	...	...	...
447.	Fallen	"	"	63	...	98	...	...
448.	Standing	17.10.13	"	5	...	...	...	...
449.	Standing	"	"	8	...	...	...	...
450.	Standing	"	"	...	...	...	...	...
451.	Standing	"	"	10	...	...	...	...
452.	Standing	"	"	17	...	...	...	...
453.	Fallen	"	"	33	...	58	...	...
454.	Fallen	"	"	21	...	73	...	...
455.	Standing	"	"	4	...	...	...	...
456.	Standing	18.10.13	"	...	...	...	...	...
457.	Standing	"	"	12	...	...	...	...
458.	Standing	"	"	18	...	25	...	...
459.	Fallen	"	"	14	...	...	...	...
460.	Fallen	"	"	...	...	...	...	...
461.	Fallen	"	"	27	...	55	...	...
462.	Standing	"	"	6	...	...	...	...
463.	Standing	"	"	...	...	...	...	...
464.	Fallen	20.10.13	"	41	...	17	...	...
465.	Fallen	"	"	18	...	25	...	...
466.	Standing	"	"	7	...	...	...	...
467.	Standing	"	"	4	...	...	...	...
468.	Standing	"	"	16	...	...	...	...
469.	Standing	"	"	9	...	...	...	...
470.	Standing	"	"	2	...	...	...	...
471.	Fallen	"	"	26	...	81	14	...
472.	Fallen	21.10.13	"	33	...	...	...	...
473.	Fallen	"	"	47	...	118	...	...
474.	Standing	"	"	5	...	...	...	...
475.	Standing	"	"	18	...	...	...	...
476.	Standing	"	"	7	...	...	...	...
477.	Standing	"	"	3	...	...	...	...
478.	Standing	"	"	...	...	...	...	...
479.	Standing	"	"	8	...	...	...	...
480.	Standing	"	"	11	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles	Pupae.	Larvae.	Eggs.	No. of trap.
481.	Standing	22.10.13	Kisimani	18	...	...	...	...
482.	Standing	"	"	...	...	...	...	...
483.	Fallen	"	"	23	...	14	...	...
484.	Fallen	"	"	35	...	...	...	...
485.	Standing	"	"	17	...	...	...	...
486.	Standing	"	"	...	...	...	...	...
487.	Standing	"	"	2	...	...	...	...
488.	Standing	"	"	8	...	...	...	...
489.	Standing	23.10.13	"	7	...	11	...	...
490.	Standing	"	"	4	...	...	...	...
491.	Standing	"	"	19	...	...	...	...
492.	Standing	"	"	23	...	18	...	...
493.	Standing	"	"	5	...	...	...	...
494.	Standing	"	"	18	...	...	...	...
495.	Standing	"	"	10	...	...	...	...
496.	Standing	"	"	9	...	...	...	...
497.	Fallen	"	"	32	...	...	...	...
498.	Fallen	"	"	40	...	17	...	...
499.	Fallen	24.10.13	"	15	...	...	...	...
500.	Standing	"	"	10	...	...	...	...
501.	Standing	"	"	...	...	...	...	...
502.	Standing	"	"	...	...	...	...	...
503.	Standing	"	"	14	...	...	...	...
504.	Standing	"	"	8	...	...	...	...
505.	Standing	"	"	3	...	...	...	...
506.	Standing	"	"	18	...	...	...	...
507.	Standing	25.10.13	"	21	...	...	...	...
508.	Fallen	"	"	23	...	51	...	...
509.	Fallen	"	"	30	...	73	...	...
510.	Fallen	"	"	...	...	...	...	...
511.	Fallen	"	"	54	...	126	...	...
512.	Standing	"	"	5	...	...	...	...
513.	Standing	"	"	...	...	...	...	...
514.	Standing	"	"	8	...	...	...	...
515.	Fallen	27.10.13	Mweli	21	...	7	...	...
516.	Fallen	"	"	33	...	18	...	...
517.	Fallen	"	"	14	...	27	...	...
518.	Standing	"	"	8	...	...	...	...
519.	Standing	"	"	9	...	...	...	...
520.	Standing	"	"	15	...	22	...	...
521.	Standing	"	"	4	...	...	...	...
522.	Standing	"	"	...	...	...	...	...
523.	Standing	"	"	18	...	...	...	...
524.	Fallen	"	"	16	...	...	...	...
525.	Fallen	28.10.13	"	23	...	53	...	...
526.	Standing	"	"	...	...	...	...	...
527.	Standing	"	"	5	...	...	...	...
528.	Standing	"	"	14	...	...	...	...
529.	Standing	"	"	19	...	6	...	...
530.	Standing	"	"	6	...	...	...	...
531.	Standing	"	"	2	...	...	...	...
532.	Standing	"	"	...	...	...	...	...
533.	Fallen	29.10.13	"	17	...	33	...	...
534.	Fallen	"	"	25	...	14	...	...
535.	Fallen	"	"	15	...	6	...	...
536.	Standing	"	"	...	...	...	...	...
537.	Standing	"	"	7	...	...	...	...
538.	Standing	"	"	1	...	...	...	...
539.	Standing	"	"	...	...	...	...	...
540.	Standing	"	"	5	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
541.	Standing	30.10.13	Mweli	3	...	...	...	...
542.	Standing	"	"	7	...	...	...	...
543.	Standing	"	"	5	...	...	...	...
544.	Standing	"	"	10	...	17	...	...
545.	Standing	"	"	...	...	...	...	...
546.	Standing	"	"	2	...	...	...	...
547.	Fallen	"	"	17	...	...	...	...
548.	Fallen	"	"	26	...	34	...	...
549.	Fallen	"	"	32	...	12	...	...
550.	Standing	"	"	4	...	...	...	...
551.	Standing	"	"	9	...	...	...	...
552.	Standing	"	"	6	...	...	...	...
553.	Standing	"	"	18	...	...	...	...
554.	Standing	"	"	...	...	...	...	...
555.	Standing	"	"	1	...	...	...	...
556.	Standing	"	"	5	...	...	...	...
557.	Standing	1.11.13	Ruruma	...	...	...	...	...
558.	Fallen	"	"	14	...	38	7	...
559.	Fallen	"	"	21	...	13	...	...
560.	Standing	"	"	6	...	...	...	...
561.	Standing	"	"	4	...	...	...	...
562.	Standing	"	"	...	...	...	...	...
563.	Standing	"	"	3	...	...	...	...
564.	Standing	"	"	18	...	23	...	...
565.	Standing	"	"	2	...	...	...	...
566.	Fallen	3.11.13	"	10	...	...	...	...
567.	Fallen	"	"	31	...	57	...	...
568.	Fallen	"	"	18	...	5	...	...
569.	Standing	"	"	6	...	...	...	...
570.	Standing	"	"	2	...	...	...	...
571.	Standing	"	"	...	...	...	...	...
572.	Standing	"	"	4	...	...	...	...
573.	Standing	"	"	17	...	8	...	...
574.	Standing	"	"	1	...	...	...	...
575.	Standing	4.11.13	"	...	...	...	...	...
576.	Fallen	"	"	...	...	...	...	...
577.	Fallen	"	"	25	...	33	...	...
578.	Standing	"	"	4	...	...	...	...
579.	Standing	"	"	7	...	...	...	...
580.	Standing	"	"	12	...	...	...	...
581.	Standing	"	"	...	...	...	...	...
582.	Standing	"	"	...	...	...	...	...
583.	Standing	"	"	14	...	...	...	...
584.	Standing	5.11.13	"	9	...	...	...	...
585.	Standing	"	"	3	...	...	...	...
586.	Standing	"	"	...	...	...	...	...
587.	Fallen	"	"	18	...	53	...	...
588.	Fallen	"	"	25	...	41	...	...
589.	Standing	"	"	...	...	...	...	...
590.	Standing	"	"	4	...	...	...	...
591.	Standing	"	"	7	...	...	...	...
592.	Fallen	6.11.13	"	10	...	28	...	...
593.	Standing	"	"	2	...	...	...	...
594.	Standing	"	"	18	...	...	...	...
595.	Standing	"	"	6	...	...	...	...
596.	Standing	"	"	1	...	...	...	...
597.	Standing	"	"	...	...	...	...	...
598.	Standing	"	"	21	...	...	...	...
599.	Standing	"	"	5	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
600.	Standing	7.11.13	Ruruma	...	...	...	...	...
601.	Fallen	"	"	17	...	31	...	...
602.	Fallen	"	"	9	...	14	...	...
603.	Fallen	"	"	31	...	53	...	...
604.	Standing	"	"	5	...	...	...	...
605.	Standing	"	"	7	...	...	...	...
606.	Standing	"	"	11	...	...	...	...
607.	Standing	"	"	2	...	...	...	...
608.	Standing	8.11.13	"	...	...	...	...	...
609.	Standing	"	"	15	...	27	...	...
610.	Standing	"	"	12	...	...	...	...
611.	Fallen	"	"	18	...	39	...	...
612.	Fallen	"	"	23	...	41	...	...
613.	Standing	"	"	...	...	...	...	...
614.	Standing	"	"	6	...	...	...	...
615.	Standing	"	"	17	...	...	...	...
616.	Fallen	10.11.13	"	10	...	2	...	...
617.	Fallen	"	"	17	...	41	...	...
618.	Standing	"	"	3	...	...	...	...
620.	Standing	"	"	9	...	...	...	...
619.	Standing	"	"	11	...	...	...	...
621.	Standing	"	"	15	...	21	...	...
622.	Standing	"	"	...	...	...	...	...
623.	Standing	"	"	2	...	...	...	...
624.	Fallen	"	"	5	...	...	...	...
625.	Standing	11.11.13	"	...	...	...	...	...
626.	Standing	"	"	18	...	13	...	...
627.	Standing	"	"	4	...	...	...	...
628.	Fallen	"	"	20	...	43	...	...
629.	Standing	"	"	2	...	...	...	...
630.	Standing	"	"	4	...	...	...	...
631.	Standing	"	"	...	...	...	...	...
632.	Standing	"	"	3	...	21	...	...
633.	Standing	"	"	18	...	...	...	...
634.	Standing	12.11.13	"	7	...	...	...	...
635.	Standing	"	"	11	...	...	...	...
636.	Standing	"	"	5	...	17	...	...
637.	Standing	"	"	...	...	...	...	...
638.	Standing	"	"	9	...	...	...	...
639.	Standing	"	"	6	...	...	...	...
640.	Standing	"	"	...	...	...	...	...
641.	Standing	"	"	10	...	...	...	...
642.	Standing	13.11.13	"	4	...	...	...	...
643.	Standing	"	"	18	...	23	...	...
644.	Standing	"	"	7	...	...	...	...
645.	Standing	"	"	5	...	...	...	...
646.	Standing	"	"	...	...	...	...	...
647.	Standing	"	"	3	...	...	...	...
648.	Standing	"	"	15	...	31	...	...
649.	Standing	"	"	6	...	...	...	...
650.	Fallen	14.11.13	"	8	...	...	...	...
651.	Fallen	"	"	4	...	...	...	...
652.	Fallen	"	"	...	...	...	...	...
653.	Standing	"	"	2	...	...	...	...
654.	Standing	"	"	7	...	...	...	...
655.	Standing	"	"	1	...	...	...	...
656.	Standing	"	"	16	...	47	...	...
657.	Standing	"	"	5	...	...	...	...
658.	Standing	"	"	9	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
659.	Standing	15.11.13	Ruruma	...	...	...	...	...
660.	Fallen	"	"	...	...	...	...	...
661.	Standing	"	"	3	...	...	...	...
662.	Standing	"	"	9	...	...	...	...
663.	Standing	"	"	...	...	...	...	...
664.	Standing	"	"	6	...	...	...	...
665.	Standing	"	"	4	...	...	...	...
666.	Standing	"	"	11	...	...	...	...
667.	Standing	17.11.13	"	9	...	...	...	...
668.	Standing	"	"	17	...	43	...	...
669.	Standing	"	"	6	...	...	...	...
670.	Standing	"	"	8	...	...	...	...
671.	Standing	"	"	3	...	...	...	...
672.	Standing	"	"	...	...	...	...	...
673.	Standing	"	"	1	...	...	...	...
674.	Fallen	"	"	25	...	82	...	...
675.	Standing	18.11.13	"	11	...	31	...	...
676.	Standing	"	"	7	...	...	...	...
677.	Standing	"	"	5	...	...	...	...
678.	Standing	"	"	...	...	...	...	...
679.	Standing	"	"	14	...	...	...	...
680.	Standing	"	"	21	...	17	...	...
681.	Standing	"	"	3	...	...	...	...
682.	Standing	"	"	9	...	...	...	...
683.	Standing	"	"	2	...	...	...	...
684.	Standing	19.11.13	"	8	...	...	...	...
685.	Fallen	"	"	31	...	104	...	...
686.	Fallen	"	"	12	...	...	...	...
687.	Standing	"	"	4	...	...	...	...
688.	Standing	"	"	17	...	3	...	...
689.	Standing	"	"	...	...	...	...	...
690.	Standing	"	"	...	...	...	...	...
691.	Standing	"	"	10	...	...	...	...
692.	Standing	"	"	3	...	...	...	...
693.	Fallen	20.11.13	"	12	...	18	...	...
694.	Fallen	"	"	28	...	52	...	...
695.	Fallen	"	"	16	...	23	...	...
696.	Standing	"	"	5	...	...	...	...
697.	Standing	"	"	9	...	...	...	...
698.	Standing	"	"	18	...	13	...	...
699.	Standing	"	"	13	...	...	...	...
700.	Standing	"	"	...	...	...	...	...
701.	Standing	"	"	3	...	...	...	...
702.	Standing	21.11.13	"	8	...	...	...	...
703.	Standing	"	"	1	...	...	...	...
704.	Standing	"	"	7	...	...	...	...
705.	Standing	"	"	...	...	...	...	...
706.	Standing	"	"	5	...	...	...	...
707.	Standing	"	"	11	...	...	...	...
708.	Standing	"	"	3	...	...	...	...
709.	Standing	"	Changombe	7	...	...	...	...
710.	Fallen	22.11.13	"	18	...	43	...	...
711.	Standing	"	"	...	...	...	...	...
712.	Standing	"	"	...	...	...	...	...
713.	Standing	"	"	...	...	...	...	...
714.	Standing	"	"	17	...	31	...	...
715.	Standing	"	"	6	...	...	...	...
716.	Standing	"	"	4	...	...	...	...
717.	Standing	"	"	7	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
718.	Fallen	24.11.13	Changombe	15	...	29	...	...
719.	Fallen	"	"	27	...	33	...	...
720.	Standing	"	"	8	...	...	...	...
721.	Standing	"	"	5	...	...	...	...
722.	Standing	"	"	9	...	...	...	...
723.	Standing	"	"	...	...	...	...	...
724.	Standing	"	"	1	...	...	...	...
725.	Fallen	"	"	18	...	...	...	...
726.	Fallen	25.11.13	"	32	...	73	...	...
727.	Fallen	"	"	21	...	82	...	...
728.	Standing	"	"	15	...	21	...	...
729.	Standing	"	"	...	...	...	...	...
730.	Standing	"	"	3	...	...	...	...
731.	Standing	"	"	7	...	...	...	...
732.	Standing	"	"	4	...	...	...	...
733.	Standing	"	"	9	...	...	...	...
734.	Standing	26.11.13	"	18	...	...	...	...
735.	Standing	"	"	1	...	...	...	...
736.	Standing	"	"	...	...	...	...	...
737.	Fallen	"	"	17	...	23	...	...
738.	Standing	"	"	5	...	...	...	...
739.	Standing	"	"	3	...	...	...	...
740.	Standing	"	"	...	...	...	...	...
741.	Standing	"	"	4	...	...	...	...
742.	Standing	27.11.13	"	4	...	...	...	...
743.	Standing	"	"	9	...	...	...	...
744.	Standing	"	"	18	...	...	...	...
745.	Standing	"	"	...	...	...	...	...
746.	Fallen	"	"	53	...	127	30	...
747.	Fallen	"	"	26	...	49	...	...
748.	Standing	"	"	8	...	17	...	...
749.	Standing	"	"	...	...	...	...	...
750.	Standing	"	Mlege	5	...	...	...	...
751.	Standing	"	"	7	...	...	...	...
752.	Standing	"	"	3	...	...	...	...
753.	Fallen	"	"	21	...	55	...	...
754.	Fallen	"	"	18	...	34	...	...
755.	Fallen	"	"	9	...	...	...	...
756.	Standing	"	"	...	...	...	...	...
757.	Standing	"	"	...	...	...	...	...
758.	Standing	29.11.13	"	19	...	...	...	...
759.	Standing	"	"	14	...	...	...	...
760.	Standing	"	"	6	...	...	...	...
761.	Standing	"	"	8	...	...	...	...
762.	Fallen	"	"	...	...	...	...	...
763.	Fallen	"	"	41	...	118	...	...
764.	Standing	"	"	...	...	...	...	...
765.	Standing	"	"	7	...	...	...	...
766.	Fallen	1.12.13	"	23	...	54	...	...
767.	Fallen	"	"	15	...	...	...	...
768.	Fallen	"	"	31	...	17	...	...
769.	Standing	"	"	18	...	39	...	...
770.	Standing	"	"	24	...	61	...	...
771.	Standing	"	"	6	...	...	...	...
772.	Standing	"	"	14	...	...	...	...
773.	Standing	"	"	...	...	...	...	...
774.	Standing	2.12.13	"	3	...	...	...	...
775.	Standing	"	"	8	...	...	...	...
776.	Standing	"	"	5	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
777.	Standing	9.12.13	Mlege	11	...	...	...	...
778.	Standing	"	"	7	...	...	...	...
779.	Standing	"	"	...	...	...	...	...
780.	Fallen	"	"	14	...	31	...	...
781.	Fallen	"	"	7	...	...	...	...
782.	Standing	2.12.13	"	5	...	...	...	...
783.	Standing	"	"	8	...	...	...	...
784.	Standing	"	"	17	...	...	...	...
785.	Standing	"	"	...	...	...	...	...
786.	Fallen	3.12.13	"	6	...	...	...	...
787.	Fallen	"	"	19	...	27	...	...
788.	Standing	"	"	...	...	...	...	...
789.	Standing	"	"	13	...	...	...	...
790.	Standing	4.12.13	Chone	6	...	...	...	...
791.	Standing	"	"	18	...	...	...	...
792.	Standing	"	"	7	...	...	...	...
793.	Standing	"	"	9	...	...	...	...
794.	Standing	"	"	15	...	23	...	...
795.	Standing	"	"	21	...	37	...	...
796.	Standing	"	"	...	...	...	...	...
797.	Fallen	"	"	13	...	...	...	...
798.	Fallen	5.12.13	"	23	...	45	...	...
799.	Standing	"	"	4	...	...	...	...
800.	Standing	"	"	...	...	...	...	...
801.	Standing	"	"	7	...	...	...	...
802.	Standing	"	"	11	...	...	...	...
803.	Standing	"	"	14	...	...	...	...
804.	Standing	"	"	6	...	...	...	...
805.	Standing	"	"	2	...	...	...	...
806.	Standing	6.12.13	"	...	...	...	...	...
807.	Standing	"	"	...	...	...	...	...
808.	Standing	"	"	8	...	...	...	...
809.	Fallen	"	"	14	...	...	...	...
810.	Standing	"	"	10	...	...	...	...
811.	Standing	"	"	3	...	...	...	...
812.	Standing	"	"	5	...	...	...	...
813.	Standing	"	"	...	...	...	...	...
814.	Standing	9.12.13	Makirunge	6	...	...	...	...
815.	Standing	"	"	7	...	25	...	...
816.	Standing	"	"	9	...	...	...	...
817.	Standing	"	"	3	...	...	...	...
818.	Standing	"	"	11	...	...	...	...
819.	Fallen	"	"	21	...	57	...	...
820.	Fallen	"	"	18	...	42	...	...
821.	Standing	"	"	4	...	...	...	...
822.	Standing	10.12.13	"	...	...	...	...	...
823.	Fallen	"	"	27	...	79	31	...
824.	Fallen	"	"	19	...	...	...	...
825.	Standing	"	"	5	...	...	...	...
826.	Standing	"	"	...	...	...	...	...
827.	Standing	"	"	7	...	...	...	...
828.	Standing	"	"	10	...	...	...	...
829.	Standing	"	"	3	...	...	...	...
830.	Standing	11.12.13	"	...	...	...	...	...
831.	Standing	"	"	8	...	...	...	...
832.	Fallen	"	"	14	...	19	...	...
833.	Fallen	"	"	11	...	...	...	...
834.	Standing	"	"	19	...	7	...	...
835.	Standing	"	"	5	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
836.	Standing	11.12.13	Makirunge	1	...	...	...	...
837.	Standing	"	"	6	...	...	...	...
838.	Fallen	12.12.13	"	31	...	115	30	...
839.	Fallen	"	"	15	...	37	...	...
840.	Standing	"	"	4	...	...	...	...
841.	Standing	"	"	...	...	...	...	...
842.	Standing	"	"	17	...	29	...	...
843.	Standing	"	"	6	...	...	...	...
844.	Standing	"	"	9	...	...	...	...
845.	Standing	"	"	3	...	...	...	...
846.	Fallen	13.12.13	"	11	...	...	...	...
847.	Standing	"	"	...	...	...	...	...
848.	Standing	"	"	2	...	...	...	...
849.	Standing	"	"	16	...	49	...	...
850.	Standing	"	"	12	...	21	...	...
851.	Standing	"	"	7	...	...	...	...
852.	Standing	"	"	...	...	...	...	...
853.	Standing	"	"	11	...	...	...	...
854.	Standing	15.12.13	"	10	...	...	...	...
855.	Standing	"	"	7	...	...	...	...
856.	Standing	"	"	12	...	41	...	...
857.	Standing	"	"	4	...	...	...	...
858.	Standing	16.12.13	Mwiraani	9	...	...	...	...
859.	Standing	"	"	4	...	...	...	...
860.	Fallen	"	"	16	...	58	...	...
861.	Standing	"	"	5	...	...	...	...
862.	Standing	"	"	3	...	...	...	...
863.	Standing	"	"	...	...	...	...	...
864.	Standing	"	"	17	...	23	...	...
865.	Standing	"	"	6	...	...	...	...
866.	Standing	22. 4.14	"	19	5	43	...	187
867.	Standing	"	"	31	9	116	...	...
868.	Standing	"	"	14	3	82	...	...
869.	Standing	"	"	6	...	...	...	...
870.	Standing	23. 4.14	"	...	...	...	...	188
871.	Standing	"	"	2	...	...	...	...
872.	Fallen	"	"	8	...	...	...	...
873.	Fallen	"	"	4	...	...	...	...
874.	Standing	"	"	9	...	...	...	189
875.	Standing	"	"	17	1	37	...	...
876.	Standing	"	"	...	...	...	...	...
877.	Standing	"	"	1	...	...	...	...
878.	Standing	27. 4.14	"	16	...	13	...	190
879.	Standing	"	"	9	...	...	...	...
880.	Standing	"	"	11	...	...	...	...
881.	Fallen	"	"	14	...	...	...	...
882.	Fallen	"	"	8	...	...	...	191
883.	Fallen	"	"	...	...	...	...	...
884.	Standing	"	"	5	...	...	...	...
885.	Standing	"	"	2	...	...	...	...
886.	Standing	"	"	16	4	58	...	192
887.	Standing	"	"	16	9	85	...	...
888.	Standing	"	"	4	...	...	...	...
889.	Standing	"	"	7	...	...	...	...
890.	Standing	28. 4.14	"	5	...	...	...	193
891.	Standing	"	"	9	...	...	...	...
892.	Standing	"	"	17	7	91	26	...
893.	Standing	"	"	4	...	...	...	...
894.	Fallen	"	"	13	...	19	...	194

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
895.	Fallen	28. 4.14	Mwiraani	...	2	43	...	...
896.	Standing	"	"	7	...	...	...	...
897.	Standing	"	"	2	...	...	...	...
898.	Standing	29. 4.14	"	18	6	72	...	195
899.	Standing	"	"	15	...	29	...	...
900.	Standing	"	"	9	...	...	...	...
901.	Standing	"	"	6	...	...	...	...
902.	Standing	"	"	2	...	...	...	196
903.	Fallen	"	"	21	11	101	39	...
904.	Fallen	"	"	19	13	101	39	...
905.	Fallen	"	"	34	9	219	...	...
906.	Standing	30. 4.14	"	...	...	...	...	197
907.	Standing	"	"	3	...	...	...	...
908.	Standing	"	"	4	...	...	...	...
909.	Standing	"	"	7	...	...	...	...
910.	Fallen	"	"	10	...	18	...	198
911.	Fallen	"	"	16	...	46	...	...
912.	Standing	"	"	...	...	...	...	...
913.	Standing	"	"	11	...	...	...	...
914.	Fallen	4. 5.14	"	6	...	...	...	...
915.	Fallen	"	"	11	...	...	...	...
916.	Fallen	"	"	4	...	...	...	...
917.	Standing	"	"	9	...	...	...	...
918.	Standing	"	"	15	...	41	...	200
919.	Standing	"	"	...	...	...	...	...
920.	Standing	"	"	7	...	...	...	...
921.	Standing	"	"	5	...	...	...	...
922.	Standing	6. 5.14	"	9	...	...	...	201
923.	Standing	"	"	...	...	...	...	...
924.	Fallen	"	"	16	7	85	...	...
925.	Fallen	"	"	19	4	72	...	...
926.	Standing	"	"	8	...	...	...	202
927.	Standing	"	"	2	...	...	...	...
928.	Standing	"	"	5	...	...	...	...
929.	Standing	"	"	12	...	27	...	...
930.	Standing	9. 5.14	Junda	21	...	10	...	...
931.	Standing	"	"	17	...	...	...	...
932.	Standing	"	"	6	...	...	...	...
933.	Fallen	"	"	43	...	165	26	...
934.	Fallen	"	"	57	...	98	...	204
935.	Standing	"	"	3	...	...	...	...
936.	Standing	"	"	9	...	...	...	...
937.	Standing	"	"	16	...	...	...	...
938.	Standing	11. 5.14	"	5	...	...	...	...
939.	Standing	"	"	8	...	...	...	...
940.	Fallen	"	"	29	...	33	...	...
941.	Fallen	"	"	35	...	121	...	...
942.	Fallen	"	"	11	...	39	...	206
943.	Fallen	"	"	51	...	117	42	...
944.	Standing	"	"	9	...	...	...	...
945.	Standing	"	"	3	...	...	...	...
946.	Standing	"	"	...	...	...	...	207
947.	Fallen	"	"	12	...	28	...	...
948.	Fallen	"	"	26	...	57	...	...
949.	Fallen	"	"	42	...	93	...	...
950.	Standing	12. 5.14	"	5	...	...	...	...
951.	Standing	"	"	10	...	...	...	...
952.	Standing	"	"	...	...	...	...	...
953.	Standing	"	"	13	...	...	...	...

COCONUT BEETLE. CUTTING OF DEAD PALMS.—*Contd.*

No. of Palm.	Description.	Date.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.	No. of trap.
954.	Fallen	12. 5.14	Junda	13	22	29	...	209
955.	Fallen	"	"	57	2	136	49	...
956.	Fallen	"	"	21	...	39	...	...
957.	Standing	"	"	9	...	...	...	...
958.	Standing	"	"	...	...	...	...	210
959.	Fallen	"	"	84	...	...	...	...
960.	Fallen	"	"	23	1	82	...	...
961.	Fallen	"	"	35	...	110	16	...
962.	Fallen	13. 5.14	"	14	...	58	...	211
963.	Fallen	"	"	10	...	...	...	...
964.	Standing	"	"	...	...	...	...	...
965.	Standing	"	"	16	...	...	...	...
966.	Standing	"	"	11	...	...	...	...
967.	Standing	"	"	3	...	...	...	...
968.	Standing	"	"	9	...	...	...	...
969.	Standing	"	"	...	...	...	...	...
970.	Fallen	"	"	30	...	92	...	213
971.	Fallen	"	"	22	...	51	...	...
972.	Fallen	"	"	17	...	...	...	...
973.	Fallen	"	"	41	...	75	...	...
974.	Standing	14. 5.14	"	11	...	...	...	214
975.	Standing	"	"	...	...	...	...	...
976.	Standing	"	"	3	...	...	...	...
977.	Standing	"	"	1	...	...	...	...
978.	Standing	"	"	6	...	...	...	...
979.	Standing	"	"	10	...	...	...	...
980.	Standing	"	"	9	...	...	...	...
981.	Standing	"	"	2	...	...	...	...
982.	Standing	18. 5.14	Freretown	5	...	...	...	...
983.	Standing	"	"	...	...	...	...	...
984.	Fallen	"	"	17	...	40	...	...
985.	Fallen	"	"	31	...	111	...	...
986.	Fallen	"	"	59	4	212	56	...
987.	Fallen	"	"	43	1	136	14	217
988.	Fallen	"	"	22	...	75	...	...
989.	Standing	"	"	11	...	...	...	...
990.	Standing	"	"	19	...	27	...	218
991.	Standing	"	"	...	...	...	...	...
992.	Fallen	"	"	26	2	59	...	...
993.	Fallen	"	"	32	1	87	...	...
994.	Standing	19. 5.14	"	10	...	...	...	219
995.	Standing	"	"	4	...	...	...	...
996.	Standing	"	"	...	...	...	...	...
997.	Standing	"	"	1	...	...	...	...
998.	Fallen	"	"	42	3	118	42	220
999.	Fallen	"	"	25	1	71	...	...
1000.	Fallen	"	"	31	...	63	...	...
				11,974	127	17,963	829	220

OPENING OF TRAPS.

No. of trap.	Date of opening.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.
1.	17.12.13	Changamwe	5	...	57	8
2.	"	"	16	6	246	60
3.	29.12.13	"	14	7	246	60
4.	"	"	8	10	211	27
5.	30.12.13	"	11	3	89	17
6.	"	"	15	6	218	10
7.	31.12.13	"	9	11	214	31
8.	"	"	11	8	315	47
9.	2. 1.14	"	15	10	276	25
10.	"	"	8	6	214	7
11.	3. 1.14	"	21	9	197	17
12.	"	"	12	7	176	14
13.	5. 1.14	"	10	...	91	...
14.	6. 1.14	"	7	...	...	...
15.	7. 1.14	"	3	...	18	...
16.	8. 1.14	"	10	...	91	...
17.	9. 1.14	"	8	1	76	19
18.	10. 1.14	"	6	...	110	7
19.	12. 1.14	"	3	...	...	...
20.	"	"	...	...	...	...
21.	"	"	2	...	...	...
22.	"	"	...	...	...	...
23.	"	"	...	...	...	...
24.	"	"	...	1	141	50
25.	13. 1.14	"	4	...	19	...
26.	"	"	...	...	43	...
27.	"	"	2	3	29	...
28.	15. 1.14	Jomvu	9	...	71	...
29.	"	"	...	...	16	...
30.	16. 1.14	"	8	...	40	30
31.	"	"	5	1	38	20
32.	17. 1.14	"	11	...	102	...
33.	"	"	...	...	...	...
34.	19. 1.14	"	3	...	19	...
36.	20. 1.14	"	2	...	19	...
35.	"	"	...	...	...	...
37.	"	"	5	...	26	...
38.	"	"	7	...	39	...
39.	21. 1.14	"	18	...	76	...
40.	"	"	4	...	13	...
41.	"	"	...	...	42	...
42.	22. 1.14	"	23	2	119	31
43.	"	"	5	...	31	...
44.	"	"	...	...	...	...
45.	23. 1.14	"	...	...	43	...
46.	"	"	3	...	17	...
47.	"	"	...	...	...	...
48.	24. 1.14	"	7	...	46	...
49.	"	"	2	...	36	...
50.	"	"	...	...	18	...
51.	26. 1.14	"	...	...	29	...
52.	"	"	5	...	28	...
53.	"	"	...	...	15	...
54.	"	"	...	...	...	...
55.	27. 1.14	"	11	...	72	14
56.	"	"	8	...	109	...
57.	"	"	...	...	31	...
58.	"	"	...	...	18	...
59.	28. 1.14	"	4	...	32	9

OPENING OF TRAPS.—*Contd.*

No. of trap.	Date of opening.	Locality.	Beetles.	Pupae.	Laryae	Eggs.
60.	28. 1.14	Jomvu	...	...	6	...
61.	"	"	1	...	...	...
62.	"	"	7	...	19	...
63.	29. 1.14	Miritini	6	...	43	...
64.	"	"	8	...	71	...
65.	29. 1.14	"	2	...	36	...
66.	"	"	...	...	19	...
67.	30. 1.14	"	7	...	31	...
68.	"	"	4	...	53	...
69.	"	"	2	...	18	...
70.	31. 1.14	"	...	...	11	...
71.	"	"	9	1	82	23
72.	"	"	...	...	13	...
73.	16. 3.14	Mazeras	...	...	40	...
74.	"	"	4	4	72	...
75.	17. 3.14	Rabai	27	...	63	...
76.	"	"	9	5	31	...
77.	"	"	46	17	115	31
78.	18. 3.14	"	...	...	14	...
79.	"	"	2	...	7	...
80.	"	"	23	...	...	...
81.	19. 3.14	"	8	...	...	...
82.	"	"	12	7	35	...
83.	"	"	19	...	42	...
84.	"	"	6	...	...	...
85.	20. 3.14	"	...	...	...	...
86.	"	"	41	18	136	53
87.	"	"	23	7	85	...
88.	"	"	57	...	118	...
89.	21. 3.14	"	29	11	73	20
90.	"	"	...	3	41	...
91.	"	"	19	...	35	...
92.	"	"	22	9	124	34
93.	23. 3.14	"	11	16	91	...
94.	"	"	...	...	11	...
95.	"	"	17	12	59	...
96.	"	"	31	7	152	23
97.	24. 3.14	"	4	5	182	...
98.	"	"	10	...	18	...
99.	"	"	15	...	39	...
100.	"	"	31	11	205	42
101.	25. 3.14	"	4	...	17	...
102.	"	"	...	...	23	...
103.	"	"	13	...	49	...
104.	"	"	10	5	62	...
105.	26. 3.14	"	27	14	119	...
106.	"	"	9	...	21	...
107.	"	"	23	3	54	15
108.	"	"	16	...	28	...
109.	27. 3.14	"	47	19	126	36
110.	"	"	11	...	29	...
111.	"	"	...	...	...	...
112.	"	"	25	17	94	...
113.	28. 3.14	"	8	...	...	...
114.	"	"	14	...	38	...
115.	"	"	32	11	112	...
116.	"	"	10	3	41	16
117.	30. 3.14	Mweli	17	...	25	...
118.	"	"	20	...	82	...

OPENING OF TRAPS.—*Contd.*

No. of trap.	Date of opening.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.
119.	30. 3.14	Mweli	9	...	...	...
120.	"	"	14	...	31	...
121.	31. 3.14	"	12	...	43	...
122.	"	"	2	...	...	...
123.	"	"	18	8	110	...
124.	"	"	22	5	97	...
125.	1. 4.14	Kisimani	18	...	27	...
126.	"	"	25	15	103	43
127.	"	"	7	...	19	...
128.	"	Mweli	31	11	126	21
129.	2. 4.14	"	43	13	92	36
130.	"	"	15	...	55	...
131.	"	"	11	...	19	...
132.	"	"	9	...	...	...
133.	3. 4.14	"	21	...	35	...
134.	"	"	14	...	23	...
135.	"	"	17	...	14	...
136.	4. 4.14	"	22	7	81	...
137.	"	"	34	23	212	57
138.	"	"	...	...	...	...
139.	"	"	13	5	41	...
140.	"	"	5	...	12	...
141.	6. 4.14	"	18	...	33	...
142.	"	"	32	6	75	...
143.	"	"	11	...	18	...
144.	"	"	...	...	...	...
145.	"	"	3	...	...	...
146.	"	"	19	...	28	...
147.	7. 4.14	"	24	14	92	...
148.	"	"	10	...	39	...
149.	"	"	...	...	...	...
150.	"	"	14	...	26	...
151.	8. 4.14	Changombe	4	...	...	...
152.	"	"	12	...	...	...
153.	"	"	9	...	...	...
154.	"	"	11	...	29	...
155.	"	"	6	...	...	...
156.	"	"	14	...	35	...
157.	9. 4.14	"	10	...	...	...
158.	"	"	17	5	48	...
159.	"	"	...	...	...	...
160.	"	"	8	...	...	...
161.	"	"	12	...	...	...
162.	"	"	9	...	...	...
163.	11. 4.14	"	23	...	...	...
164.	"	"	11	...	26	...
165.	"	Mlego	14	3	37	...
166.	"	"	29	7	59	...
167.	"	"	8	...	21	...
168.	"	"	19	...	...	...
169.	14. 4.14	"	...	...	...	...
170.	"	"	3	...	...	...
171.	"	"	15	5	43	...
172.	"	"	12	3	51	...
173.	"	Makirunge	7	...	...	...
174.	"	"	4	...	...	...
175.	15. 4.14	"	19	...	32	...
176.	18. 4.14	"	...	...	...	...
177.	"	"	9	...	...	...

OPENING OF TRAPS.—*Contd.*

No. of trap.	Date of opening.	Locality.	Beetles.	Pupae.	Larvae.	Eggs.
178.	18. 4.14	Makirunge	16	4	46	...
179.	"	"	5	...	...	...
180.	"	"	8	...	...	...
181.	20. 4.14	"	11	...	...	...
182.	"	"	4	...	...	...
183.	"	"	...	...	...	...
184.	"	"	10	...	...	...
185.	22. 4.14	Mwirarani	19	3	52	...
186.	"	"	3	...	...	...
			1,998	433	9,210	905

Citrus Fruits.

PAPILIO DEMODOES, ESP (the Citrus Butterfly).—This occurs wherever citrus fruits are grown in the Protectorate, but nowhere has it been found in very large numbers. The caterpillar is parasitised by an Ichneumon, but not to a marked extent.

The addition of a small quantity of soft soap and gelatine to the arsenate of lead or other spray used against this caterpillar increases the wetting power of the liquid, the deposit of poison also being rendered more adhesive to the leaf surface. With such an addition, a thorough spraying remains effective for many months.

Hand picking of caterpillars on young stocks in a nursery is often necessary.

THE CITRUS MOTH.—A small Pyralid moth is the most serious pest so far met with, but seems for the present to be confined to Nairobi and the neighbourhood.

All varieties of oranges are attacked, and naartjes to a smaller extent.

The eggs of the moth are laid singly on the fruit. The egg is flattened, white and reticulated, .9mm broad, and .6mm approximately deep.

The minute white caterpillar, on leaving the eggs, bores into the orange always on the outermost ripest side. The opening made by the caterpillar is exceedingly minute and very little of the rind is removed during its formation. Such being the case, stomach poisons—though these have been experimented with—are of little use against the caterpillar.

Once inside, the caterpillar enlarges its burrow considerably within the pulpy rind, and grows appreciably before attacking the juice-filled cells of the fruit.

Very often only a small portion of the fruit is traversed by the caterpillar, which then leaves by a conspicuous hole close to the place of entry. On the other hand it may bore to the centre of the fruit and eat portions of the seeds. In such a case it may leave the fruit by a hole at the opposite pole from that at which it entered.

The exact time spent within the fruit has not been accurately determined, but it cannot be less than fourteen to twenty-one days.

The full-grown caterpillar is about 14mm long, pinkish red in colour, with brown prothorax and well developed legs. On leaving the fruit it pupates at once in the surface soil, making a cell of soil particles.

The pupal period lasts on the average 38 days, but may be as short as 29 days or as long as 44 days.

The imago is dark brown and some 10mm long. It appears to prefer exposed conditions during the daytime; possibly it may be attracted by light.

Attacked fruit usually falls prematurely. In the middle of June, out of 544 fruits collected from the ground during a period of fifteen days from 60 six to seven year old trees, 361 had been attacked by the caterpillar, leaving 183 which had fallen through some other cause.

In the orchard in which the pest has been studied, oranges are borne by the trees practically the whole year round, so that it might be possible for the moth to continue its life-cycle throughout the year. At the same time there is little doubt that hibernation or a resting period occurs, but when and how is not yet determined. It can scarcely occur in the fruit since in a well regulated orchard periods would occur when no fruit would be available.

Since the caterpillar only enters on the more or less ripe outer surface of the fruit, spraying with stomach poisons can be confined to this surface. A spraying experiment with lead chromate has been attempted, but without results, as the sprayed trees showed no advantage over the controls. As already mentioned, the margin in which the caterpillar can be poisoned is a very small one, especially as it is not possible to cover the surface completely with poison, even when the suspension is as fine as that of freshly precipitated lead chromate.

As yet it is not known whether other fruits are attacked by this moth. If not it might be possible, in the case of an isolated orchard, to starve out the pest by preventing the development of all fruit during one season.

All attacked fruit should be destroyed at once or buried in a deep pit.

Constant raking over and cultivation beneath the trees will destroy many pupæ, as the caterpillar does not wander from the point where it leaves the orange; in fact it may pupate immediately below the fallen fruit.

DIPTEROUS ENEMIES.—No Trypetid flies have been recorded attacking citrus fruits. The attack of the Pyralid caterpillar is followed by that of Drosophilid flies, which are enabled to lay their eggs in the oranges by means of the small openings left by the caterpillars.

SCALE INSECTS.—Several species of *Lecanium* have been recorded, but these have not yet been definitely identified, *Icerya purchasi*, Maskell—the cottony-cushion scale—has been found in the Limoru district. Only a few individuals were seen. The insect failed to thrive in the insectary. Possibly this scale does not increase rapidly in the Protectorate, but until its behaviour in established orchards is studied no conclusions can be drawn.

Chrysomphalus aurantii, Maskell.—A scale closely answering to the description of this species has been found on young imported stock.

Vinsonia stellifera, Eastwood, occurs in small numbers.

THE CITRUS PSYLLA.—This occurs everywhere, and in connection with aphids may very considerably distort young growing shoots and generally injure the growth of the tree. Gathering the pitted leaves and those carrying the very numerous eggs and burning them helps to control the pest.

CITRUS APHIDES.—The common aphid on citrus trees is *Aphis tavaresi*, Del Cuereio, the black citrus aphid, and occurs generally throughout the Protectorate. It is believed that heavy showers of rain help to keep this insect in check. It is very irregular in its occurrence, appearing suddenly and multiplying rapidly and then disappearing. Only a few parasitized individuals have been found. *Toxoptera aurantii*, Boyer—the black citrus Toxoptera—has also been recorded from several localities.

MITES.—An unidentified species of small red mite (*Acarina*) has been found on citrus fruit. So far as has been observed only the fruit is affected, the injury occurring principally towards the end of the fruiting season. The fruit may be attacked when quite young, and assumes a silvery and scabby appearance due to the killing of the outermost cells of the rind. As the rind hardens distortion of the fruit results, due to irregular growth.

The eggs are laid in groups on the fruit, are bright red in colour, and hatch out in the course of a week or so.

Powdered sulphur is effective against these mites, but the maintenance of healthy soil conditions, irrigation if necessary, and the removal of all fruit developing after the fruiting season is over, are better methods of control.

Coffee.

SCALE INSECTS.—The following scale insects have been recorded from coffee:—

Lecanium africanum, Newst.—This is by far the commonest scale, and occurs on young and old trees alike. It has also been found in nursery beds. Both the upper and lower surfaces of the

leaves and also the stems are attacked. Specimens of this scale from all parts of the coffee growing areas have been examined, and up to date the closely allied form *Lecanium viride*, commonly known as the green bug, has not been found. Rosin and caustic soda spray is an effective remedy. It is safe during dull weather in June or July, to use a 10 per cent. kerosine emulsion spray; during bright weather a 5 per cent. spray should be used. Kerosine emulsion sprays are very seldom recommended now in this Protectorate, as, no matter how careful the planter may be, some scorching of the leaves does occur. A Coccinellid, black with four red spots, has been found feeding on this scale.

Lecanium hæmisphericum, Targioni-Tozzetti, occurs occasionally.

Lecanium nigrum, Nietner, was found in the Muhoroni Highlands at an altitude of 6,000 feet. This species is heavily parasitized.

Pulvinaria psidii, Maskell, occurs occasionally. Several other species of as yet unidentified scales have been recorded.

Generally speaking plantations are very free from scale insects, and it is usually only an odd tree here and there that is attacked. This speaks well for the healthy condition of the trees, and gives the planter an excellent opportunity to eradicate scale insects from his plantation. It is to be hoped that in the near future every plantation will be equipped with the requisite spraying apparatus.

CUTWORMS.—*Euxa segetum*, Schiff, and *Polia inferior*, Guen, appear to be the two commonest Lepidopteron enemies of coffee in the Protectorate. The former moth, the caterpillar of which is the large grey, greasy looking cutworm, is a very serious pest. Cutworms have been found throughout the year and have been recorded as damaging coffee, maize, tobacco, potatoes and peas. Coffee trees are ring-marked, usually at the soil level, though sometimes much higher up. The damage may remain unobserved for months until the leaves turn yellow or the bush is blown over by the wind. Trees are not safe from cutworm attack until the bark has been thoroughly hardened.

Careful search for cutworms, which are usually easily found in the soil at the base of the tree if present in dangerous numbers, should be made not only at the time of planting but at frequent intervals afterwards. Prompt measures can then be taken and attacked trees replaced.

The use of both green bait, *e.g.*, lucerne or wild mustard soaked in a solution of arsenite of soda and mealy meal or sweetened bran mixed with paris green, has, in many instances, proved a complete success, but the value of these methods is not universally realised.

It is a common practice to grow mealies between the coffee as a catch crop, and doubtless this plan has its advantages. When, however, it is the planter's main object to establish coffee as rapidly as possible, and where there is danger of cutworms, the safest plan is to keep the ground not only free from all weeds but from catch crops as well. A clean field planted only with coffee offers neither shelter nor suitable breeding places for egg deposition to the cutworm moth.

Numerous Ichneumon and Tachinid parasites have been reared from the caterpillars of *Euza segetum*, and these, to some extent, help to keep down the numbers of the cutworms.

THE COFFEE BUG (*Antestia variegata*).—This pest seems to be on the increase, and has been recorded from several new localities. Its presence is manifested in three ways:—

1. The primary and secondary branches become stunted and covered with numerous adventitious shoots and leaves. This makes pruning a more difficult and costly process, and moreover reduces the producing powers of the trees.

2. The development of unripe berries is checked and they turn a blackish colour.

3. When the parchment is removed from the beans, dark markings due to the puncturing by the proboscis of the bug are noticeable.

Control experiments have not met with much success. The bugs are too scattered over the trees, and also too agile for contact spraying to be effective. Until some better method of control is discovered—and apparently this can only be arrived at by a close study of the habits of the insects—hand collecting is the best control method available. During a collecting experiment one boy collected 230 bugs in two hours, which works out at about 1,000 per boy per day.

Specimens of *Bagrada picta* have also been found on coffee.

THE LEAF MINER (*Cemiostoma coffeelum*).—Although this pest is not regarded as serious, its importance should not be overlooked, especially when loss of foliage is being caused simultaneously by other diseases. The disease does not seem to exist in the Muhoroni coffee area.

THE COFFEE MOTH (*Thliptoceras Octoguttalis*, Feld).—This, at present, is not a serious pest, though it has a wide distribution. The caterpillar eats out the contents of the green berries, and as it passes from berry to berry it binds them together in a loose web.

BETLE ENEMIES.—*Apate monacha*, F, has been recorded from several areas as boring in coffee. The true coffee borers, *Anthores leuconotus*, etc., have not been found in any of the recognised coffee areas.

Cockchafers, *Schizonica*, *Anomala*, etc., have caused damage in some plantations by eating the foliage.

Genocephalum contractum (Tenebrionidæ) has been reported by Mr. Trench as having been found in one plantation climbing the bushes and eating the leaves and young shoots.

DECIDUOUS FRUITS.

The Apple.

Eriosoma lanigerum, Hausmann—the Woolly Aphis—occurs in the Ulu, Kyambu, Kabete and Nairobi districts. The spread of this pest is facilitated by the fact that the insects penetrate to the core of the apple. This aphid thrives in the Protectorate, and unless the root and aerial forms can be destroyed simultaneously it is not possible to clear the trees.

With the exception of the Ulu district, most of the trees are not very old, and have not attained any great size, so that treatment is not difficult, and it is possible to clear the trees completely.

The Coccinellids *Exochomus flavipes* and *Hippodamia variegata* were found on infested trees apparently feeding on the aphids.

A species of scale, believed to be a *Diaspis*, is common. The Coccinellid, *Chilocorus distigma*, Kl., feeds on this scale.

The cockchafer, *Oxythyrea elegans* Kl, feeds on the blossoms but is not a serious pest.

Plum, Peach.

Drosophilid Flies lay their eggs on ripe fruit on the trees. Their attack appears to follow that of some sucking insect, which first punctures the fruit. The flies of this family are usually considered as attacking only rotting fruit, but here they may have to be regarded as pests as they render valueless much fruit which could otherwise be utilised.

Large Saturnid caterpillars have been found eating the foliage of Japanese plums. They are easily collected and destroyed by boys.

A large black and white Cerambycid beetle is believed to be responsible for damage to plums and apricots on the Mua Hills. The trees are slowly killed by the borings of the larvæ in the branches and stems.

Scale insects in fig, papaw, peach and apple have been sent to England for identification.

Quince.

THE QUINCE MOTH (*Orgyia vetusta*, Hmp.)—The caterpillar of this moth eats the foliage of quince trees, which it may strip completely. It has also been recorded from apple and black wattle.

The female is wingless, and lays a mass of 150 to 200 eggs. The caterpillars are black with yellow markings; during the latter stages they are conspicuously coloured with red and white. If shaken on to hot earth at midday they quickly succumb unless they can reach shelter. When quite small the caterpillars are parasitized by an *Ichneumon*, the average number developing in each caterpillar is seven. The percentage of caterpillars parasitized was worked out to be 77 per cent., so that the natural controls have this pest well in hand.

The larval life lasts approximately a month. Pupation takes place in a silken cocoon on the leaves.

Black Wattle.

THE WATTLE BUG AND HOPPER.—About this pest, which is the most serious yet recorded from wattle, Mr. Deakin makes the following remarks in one of his reports:—"The best example of the damage which these insects can do to wattle was met with on Farm No. 151, where the Ruraka River crosses the Nairobi-Limoru road. The plantation is at an approximate altitude of 6,500 feet. In this plantation trees two and a half years old had the appearance of flat-topped shrubs. Most of the leaves of the upper portion of the trees had fallen, and an excessive and quite abnormal production of small shoots had transformed the tops of many of the trees into mere tangled clumps, reminiscent of "witches brooms." No bugs or hoppers were evident until the clumps were violently shaken, when the insects became very apparent, especially the immature forms. On another farm I examined 50 acres of attacked wattle. The trees were considered to have had their growth retarded by six months, and at one time were actually higher than at present. Strange to say, the parts of this plantation most exposed to the wind were the most affected. I am of opinion that many of the attacked plantations were 'getting away' from the pest at the time of my visit, new growth being evident."

"This disease is very serious at Njoro, where on Lord Delamere's estate many hundred acres of two-year-old trees are affected, the growth being checked and the trees being terribly stunted and misshapen. On examination it was found that only the Capsid bug was present, and not the Jassid hopper, though both have previously been found at Njoro. On a neighbouring estate wattle planted on similar ground and in a similar position has never been affected by this disease."

On one plantation close to Kabete, where the disease was bad, there are now no signs of it, and the trees have recovered and are tall and of good shape.

Mr. Deakin is carrying out investigations on this and other pests of wattle.

Other pests which have been recorded during the year under review are:—

TOBACCO.—Cutworms, Split-worm, Leaf-eating Beetles.

BEANS.—*Mylabris distincta*, eating the leaves.

MAIZE.—*Chloridea obsoleta*, F., attacking the cobs; an undetermined stem-borer.

BROOM CORN.—*Macrosiphum granarium*, Kirby, and *Aphis africana*, Theo., sp. nov., seem to be the common aphids on broom corn.

Culucidæ.

The following new species have been collected during the year. These have been described by F. W. Edwards, B.A., F.E.S., in the Bulletin of Entomological Research, Vol. 4, Part 1, and Vol. 5, Part 1.

Teniorrhynchus versicolor, Edw., sp. nov.

B.E.A.: 1o (type), Nairobi, 16.7.12. (T.J.A.).

Culex mirificus, Edw., sp. nov.

B.E.A.: 1o (type), Njoro, 28.1.12. (T.J.A.).

Culex triflatus, Edw., sp. nov.

B.E.A.: 18o (including type) 31o, Kabete, 11/13, (T.J.A.)

Culex andersoni, Edw., sp. nov.

B.E.A.: 18o (including type) 12o, Kabete, 2.8.13. (T.J.A.)

Culex perfuscus, Edw., sp. nov.

(Type from Nyasaland) 1o, Kabete, 11/13 (T.J.A.)

Culex aurantapez, Edw., sp. nov.

B.E.A.: 1o, Nairobi, 18.8.12. (T.J.A.)

Aphideæ.

The following new species of Aphids have been collected in the Protectorate, and are named and described by Fred V. Theobald, M.A., F.E.S., in the Bulletin of Entomological Research, Vol. 4, Part 4.

Macrosiphum lophospermum, sp. nov.

LOCALITY.—Njoro, 1/12, T.J.A.

FOOD PLANTS.—*Lophospermum erubescens*.

Macrosiphum lycopersicella, sp. nov.

LOCALITY.—Njoro, 16/1/12, T.J.A.

FOOD PLANTS.—Cape Tomato, Rape.

Aphis solanella, sp. nov.

LOCALITY.—Njoro 1/13, T.J.A.

FOOD PLANTS.—*Solanum* sp.

Aphis africana, sp. nov.

LOCALITY.—Njoro, 1/12, T.J.A.

FOOD PLANTS.—Broom Corn, Barley.

The following is a complete list of the Aphididæ recorded from the Protectorate:—

- Macrosiphum lophospermum*, Theo.
Macrosiphum lycopersicella, Theo.
Macrosiphum antirrhinum, Macchiate.
Macrosiphum granarium, Kirby.
Rhopalosiphum lactucæ, Kaltenbach.
Aphis brassicæ, Linnæus.
Aphis gossypii, Glover.
Aphis tavaresi, Del Guercio.
Aphis solanella, Theo.
Aphis africana, Theo.
Toxoptera aurantii, Boyer.
Toxoptera graminum, Dondani.
Erisoma lanigera, Hausmann.

I have the honour to be,

Sir,

Your obedient servant,

(Signed) THOS. J. ANDERSON,

Entomologist.

ANNUAL REPORT

OF THE

PLANT IMPORT INSPECTOR

FOR THE

YEAR ENDING 31ST MARCH, 1914.

DEPARTMENT OF AGRICULTURE,
MOMBASA,

10th April, 1914.

THE GOVERNMENT ENTOMOLOGIST,
DEPARTMENT OF AGRICULTURE,
NAIROBI.

SIR,

I have the honour to submit my annual report for the year ending March 31st, 1914. On December 1st I took over the duties of Plant Import Inspector from Mr. Barlow.

Inspection of Seed and Plant Imports.

Consignments to the number of 1,240, valued at Rs. 65,224, were passed for entry into the Protectorate and fumigated when necessary.

Consignments.	Description.	Value in Rupees.
221	Farm Seeds	11,622
255	Vegetable and flower Seed ...	4,557
245	Tree Seeds	5,621
210	Fruit Trees	39,598
97	Ornamental Trees	968
72	Vegetable and Ornamental Plants	742
27	Bulbs	327
113	Roasted Coffee	1,889
1,240	Total	65,224

Thirteen consignments, valued at approximately Rs. 800, were confiscated, including Coconuts, Seed Potatoes, Coffee Seed and Peachstones. In transit for Uganda, the Belgian Congo, and German East Africa, 192 packages, valued at Rs. 9,342, were

passed; these included coffee berries, which were sealed upon entry into this Protectorate. Concerning the matter of obtaining permits to import certain seed and fruit trees, these often arrive without any permit for their importation having been first obtained.

In the matter of packing many nurserymen, especially Englishmen, have very little idea of packing for transit through the tropics, and plants at times arrive in a dying condition.

Out of 210 consignments of fruit trees, valued at Rs. 39,598, citrus trees accounted for 115 packages, valued at Rs. 28,864, from South Africa and Australia. This, a considerable increase on the numbers imported in other years, speaks well of a growing industry in the country. Olive trees have also passed into the country, and judging by the growth of the indigenous olive they should prove a success, but considering the great adulteration of this product it still remains an open question as to whether the growing of olives for oil production would be a profitable industry.

A number of plants come into the country packed in tins of soil.

Maize Exports.—The amount of maize passed for export was 7,050 tons. I have fumigated 70 tons and condemned 40 tons as being unfit for export.

The quantity exported is slightly less than the amount in the previous year. Probably this difference could be accounted for by the failure of the short rains. Judging from the much smaller quantity that required fumigating this year the quality must be much better.

Messrs. Besson and Co., and Messrs. The B.E.A. Corporation, Ltd., exported several consignments of good quality Hickory King maize.

The bulk was native mixed maize, and though free from weevil, in many cases was not of high grade on account of the amount of dirt and alien seeds that it contained.

A meeting was called by the Director of Agriculture on December 17th to discuss the question of maize export and grading.

There can be little doubt that the plan of grading advocated at that meeting is necessary to put the maize trade on a sound basis. The erection of the godown which is contemplated will materially alter the conditions of fumigating, grading and shipping.

The enclosed tables show the monthly particulars of the imports and exports for the year.

I have the honour to be,

Sir,

Your obedient servant,

(Signed) H. B. SHARPE,

Plant Import Inspector.

**Maize Exports from April 1st, 1913, to
March 31st, 1914.**

Date.			England.	Germany.	Belgium	Italian Somaliland	Benadir.	Zanzibar.	TOTAL.
April,	1913	...	...	...	...	...	640	80	720 tons.
May,	"	...	...	150	50	...	90	...	290 "
June,	"	...	10	180	...	...	...	...	190 "
July,	"	...	120	250	60	...	...	...	430 "
August,	"	...	40	350	450	...	40	20	900 "
September,	"	...	160	900	40	30	...	...	1,130 "
October,	"	...	400	800	300	...	...	...	1,500 "
November,	"	...	530	520	...	30	...	...	1,080 "
December,	"	...	160	310	...	...	...	20	490 "
January,	1914	...	20	90	...	...	...	...	110 "
February,	"	...	...	...	...	...	90	...	90 "
March,	"	...	...	60	50	...	10	...	120 "
Totals			1,440	3,610	950	60	870	120	7,050 tons.

Plant and Seed Imports from April 1st, 1913, to March 31st, 1914.

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Date.	Farm Seeds.		Flower and Vegetable Seeds.		Tree Seeds.		Fruit Trees.		Orna-mental Trees.		Vegetable and Orna-mental plants.		Bulbs.		Roasted Coffee.		Total.	
	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No.	Rs.	No. of Pkges.	Value Rs.
April, 1913	58	1,457	21	254	6	190	2	32	17	82	2	5	6	58	24	396	136	2,474
May, "	14	111	22	352	21	1,100	2	20	7	85	10	98	1	15	26	336	103	2,117
June, "	6	371	33	253	87	697	4	155	6	50	3	29	...	...	25	451	164	2,006
July, "	2	16	19	537	3	29	48	5,770	2	12	9	16	2	15	...	...	95	6,395
August, "	8	372	16	573	2	44	23	7,068	1	15	1	15	...	...	...	...	51	8,087
September, "	1	50	20	422	6	95	26	7,812	12	105	5	108	...	2	...	...	71	8,594
October, "	50	700	13	211	12	202	8	10,755	3	3	4	96	1	...	...	...	90	11,917
November, "	5	5	36	631	12	137	10	1,855	7	16	7	56	3	46	12	111	92	2,857
December, "	8	99	20	290	6	129	21	530	12	122	2	27	1	5	1	5	71	1,207
January, 1914	6	476	14	208	7	301	32	3,115	9	135	7	234	4	57	...	...	69	4,526
February, "	23	682	14	432	29	224	16	784	6	103	19	83	5	70	25	590	137	2,968
March, "	40	7,283	27	394	54	2,373	18	1,702	15	240	3	25	4	59	...	...	161	12,076
Totals	221	11,622	255	4,557	245	5,521	210	39,598	97	968	72	742	27	327	113	1,889	1,240	65,224

ANNUAL REPORT

ON THE

GOVERNMENT STOCK FARM, NAIVASHA

FOR THE

YEAR ENDING 31ST MARCH, 1914.

GOVERNMENT STOCK FARM,

NAIVASHA,

BRITISH EAST AFRICA.

THE HONOURABLE

THE DIRECTOR OF AGRICULTURE,

NAIROBI.

SIR,

I have the honour to submit my annual report for the year ending March 31st, 1914.

The rainfall during the year was as follows:—

April,	1913	...	...	3.17
May,	"	...	...	5.99
June,	"	...	...	6.57
July	"	...	...	0.65
August	"	...	...	2.13
September	"	...	...	0.08
October	"	...	...	1.65
November	"	...	...	2.10
December	"	...	...	2.46
January,	1914	...	...	0.29
February	"	...	...	0.95
March	"	...	...	5.72

Total ... 31.76

In comparison with previous records the rainfall has been heavier; it has also been fairly evenly distributed, and in consequence the pasture was green and succulent throughout the year.

A case of East Coast Fever occurred on the farm in July, 1913. Fortunately the cattle dipper had been completed, allowing of dipping being started without delay.

From the date of the outbreak until May, 1914, the three days dipping with Cooper's solution of arsenite of soda was practised, after which date the stock have been dipped once a week only. There were no further cases of East Coast Fever, but at the commencement of the dipping the cattle fell off somewhat in condition, and it was found that the skins of the calves under got slightly burned.

The pure-bred shorthorns have done well with the exception of one or two cows which aborted, and the calves and the Lincoln Red shorthorns all promise to be good.

The pure-bred Friesland cattle have done exceptionally well, and the development of the young pure-breds here is exceedingly good and worth marked notice.

The pure-bred Herefords have not been the success that one would have expected, and the increase has been disappointing.

The Ayrshire pure-bred cattle, as stated in my previous reports, have done exceedingly well, and the return of calves has been better than from any of the other breeds on this farm.

In the pure-bred Ayrshire, twins were born on three occasions during the year. Two pairs are alive and doing well; one of the third pair died at birth through an accident; the other is alive and fit.

The Friesland and Ayrshire pure-bred cattle are exceedingly good milkers and do their calves well. The shorthorns have done their calves well, but are not quite as good milkers as the two former breeds. As for the few pure-bred Hereford cows, it takes them all their time to feed their calves.

Grade Cattle.—The grade shorthorn cattle have done well, both the half-bred and the three-quarter-bred and the seven-eighth (first cross, second cross and third cross) shorthorns, and appear to be a success. They are certainly a great improvement on the native cattle as regards quantity of milk, size, and bone, and there are some splendid third cross shorthorn calves on the farm.

There is a cross here known as the Guernsey shorthorn cross, which is native x Guernsey x shorthorn x shorthorn. These cattle are good both in frame and milking qualities. We have raised (bred) to the fourth cross and there is no appearance of deterioration in them. A reference to my previous reports will show that I mentioned these cattle as being of very good promise, and I am still of the same opinion.

The Friesland grades are bred from imported South African grade cows, and of course are of good quality.

The Hereford grades are very nice cattle to look at. Both the second and third crosses look well, and so do the fourth cross calves. I could pick out Hereford grades which could favourably compare with any Hereford grade in the country, but as an all-

round proposition the Herefords on this farm, up to the present, have not done as well as the other breeds established. Very likely now that dipping is the order of the day the Herefords will do better, as tick diseases are the main trouble with them, and affect them more than the other breeds.

The Ayrshire grades have done well, and the opinion held by many is that they cross with the native cattle better than any of the other breeds. In any case we have splendid half-bred, second cross and third cross with the native cattle. As milkers they are certainly good. It is worthy of note that we have not a barren pure-bred Ayrshire or grade Ayrshire cow on this farm.

There has been a tendency among some of the pure-bred shorthorns on this farm to go barren, but I do not find this in the Lincoln Red shorthorns.

There has been a great deal of talk with some people that it is impossible to directly cross the shorthorn with the native cattle without throwing in another breed as well.

I am of opinion that where smallness of bone, etc., has been noticed in the higher crosses of this breed it was due to the fact that in breeding up from the native, the half-breed—a heifer—was put to the bull too young, that together with the fact that her first calf again was put to the bull too young, and so on, coupled with the knowledge that all these calves were heifer's first calves, has the great tendency to make this or any direct cross breed a failure. I cannot say that I have noticed any deterioration in any of the higher crosses on this farm.

It is my intention to test the milk of the various crosses and breeds as to butter fat and quantity of milk given. Up to the present the greatest quantity of milk given by a grade cow was taken from a grade Ayrshire, but I cannot say that the grade shorthorns milked very well. It will be interesting in a while to cross these grades as an experiment, and this I hope to do with a limited number, as well as trying the experiment of crossing the direct higher crosses of shorthorn with one another, say a fourth cross shorthorn bull with a fourth cross shorthorn cow.

The stud bulls on the farm are as follows:—

- 1 Coates Shorthorn from Sir Richard Cooper's herd.
- 1 Lincoln Red Shorthorn, which has several first and champion prizes.
- 1 Friesland.
- 1 Hereford Bull.
- 2 Ayrshire Bulls, one of which held the Championship of Great Britain (in his breed) for 1911 and 1912, and his full brother carried the Championship at home in 1913.

It is considered that as a group of bulls of different breeds they compare very favourably with stud bulls on any of the Government stations either in South Africa or Australia.

We are ordering more shorthorn cows and Friesland cows and a Hereford bull to arrive during the present year. At the recent Nakuru Show on February 6th, 1914, the Naivasha Farm carried the Championship with an Ayrshire for the best bull in

the show yard. We also took the Championship for the best pure-bred cows in the show yard, as also the second and third places in this class. The champion cow was an Ayrshire imported, and the runners-up in this class were two country bred Ayrshire cows bred on this farm.

We sent a lot of pure-bred and grade cattle to the Show for exhibition only, and they were much admired. We only competed for championship classes, and I am very glad to say were successful for both the bulls and the cows.

Sheep.—The sheep have done well, the increase being satisfactory. The wool clip was good, clean, and free from dirt. The weight of the fleeces was a little higher than in previous years, being freer from earthy matter. As in my previous reports, I still favour the pure Merino sheep. The crosses that have proved most profitable have been the direct Merino cross on the Native and a Merino ram on each successive cross. The only cross that came up to the direct Merino cross was the one where we used the pure Lincoln ram on the Native ewe and first cross, and then a Merino ram on each cross afterwards. This class of sheep is exceedingly good, and has a very nice robust wool with good length of staple.

There are on the farm a number of Native x Down x Merino grades. Some of these are nice sheep and have good frames, but the wool is not quite up to the quality from the direct Merino grades or from those with a blend of Lincoln.

The mutton sheep which have done the best are the Suffolk grades, that is a Suffolk on a Native ewe and then a Suffolk on each cross afterwards. It is the intention to conduct some experiments with these sheep by mating fourth grade ewes with fourth grade rams, with the view to evolving a utility type of sheep with fixed characteristics.

Out of a flock of 2,300 sheep of all ages the mortality during the year was 201; the greater number of the deaths were lambs and young sheep. Owing to the wet seasons experienced worms proved troublesome, and it was necessary to dose frequently, especially the mutton crosses, which were more affected than the other breeds. The higher grades of mutton sheep were more affected with lung troubles.

The Wool Clip.—The wool this year was freer from earthy material, but contained a considerable quantity of bur, and the prices realised were not quite up to those obtained for the previous clip.

The Stud Merino ewes' top weight fleece was 20½ lbs., and the lowest 12 lbs.

The Flock Merino ewes' top weight fleece was 11½ lbs., and the lowest weight 5 lbs., but there were very few of the latter. The average weight being about 8½ lbs. for ten months' growth.

The Merino rams' fleece top weight was 28 lbs., and the lowest weight off young rams 12 lbs.

Fourth grade sheep, Merinos, carrying ten months' growth cut as follows:—Top weight fleece, 8 lbs.; lowest weight, 4 lbs.; and average weight about 6 lbs.

Third cross Merino:—Top weight, 8 lbs.; lowest weight, 3 lbs.; but there were very few of the latter. The average was nearly the same as the fourth cross, but the quality of the wool was not quite as good.

Second cross Merino ewes:—Top weight fleece, 6 lbs.; lowest weight, 3 lbs.; and average about $4\frac{1}{2}$ lbs.

Fourth cross, Native x Lincoln, Merino x Merino x Merino ewes cut:—Top weight, 9 lbs.; lowest, 3 lbs., off young ewe hoggins.

This year the pure-bred Merino, which was sold on one lot, realised $10\frac{1}{2}$ d. per lb., and for the grade Merino wool, which was also disposed of in one lot, 10d. per lb. was obtained, which may be considered very fair prices.

A consignment of pure-bred Merino sheep was imported from Messrs. Faulkner and Sons' Bonake Stud Flock. The consignment included two very high class rams, one of which was awarded the champion prize at the Nakuru Show.

Angora and Grade Angora Goats.—The Angora and the grade Angora goats have done very well, and the increase has been good. The price obtained in London for the mixed grade Angora Mohair was $9\frac{1}{4}$ d. per lb.

Donkeys.—The crossing of the native donkey mares with the Catalonian jackass is proving a success, the progeny being superior in size and bone than their dams.

Ostriches.—Small troop of birds in all, have since their removal to the Lake Paddocks improved in condition, and the returns for the feathers have been very satisfactory, notwithstanding the fall generally in the price of ostrich feathers. Two cocks and one hen were imported from Madagascar recently; these birds came originally from South Africa. They are smaller in size than our native birds, but the plumage is of much higher quality. Good results are anticipated from the mating of them with the native ostrich.

Horses.—The stallion "Royal For" has again proved a good foal getter, and his progeny is very promising when the class of mare sent to the shed is taken into consideration, and the general opinion is, the importation of this horse has been of marked benefit to the horse breeding industry.

The Annual Sale.—The annual sale took place on March 6th, 1914, and there was a goodly number of farmers present, most of whom were buyers. Bidding was keen, and very satisfactory prices obtained for most of the stock disposed of.

- 4 Shorthorn bulls sold from £38 to £62.
- 1 Friesland yearling bull sold at £66.
- 11 Young Ayrshire bulls sold at from £44 to £92
- 1 Grade Friesland bull sold at £45.
- 1 Three-quarter bred Hereford bull sold at £10.
- 4 Quarter-bred Ayrshire young bulls sold from £13 to £21 6s. 8d.
- 2 Half-bred Hereford cowe with calves at foot sold at £17 and £19 6s. 8d.
- 2 Three-quarter bred Hereford cows sold at £15 6s. 8d. and ££1 13s. 4d.
- Half-bred Catalonion young jackasses sold from £5 to £7 each.
- 119 Pure Merino rams, composed mostly of young stock, sold from £2 to £6 6s. 8d.
- Grade rams sold from 12s. to 32s.
- Cull Merino ewes sold at 10s.
- Grade cull ewes sold from 4s. 8d. to 16s. 9d.
- Young wethers sold from 10s. 8d. to 14s. 4d. off shears.
- Pure Angora rams sold from 7s. 4d. to 14s. 8d.
- Grade Angora ewes sold at 8s. to 8s. 8d.

General Remarks.—The bulls imported from Europe some time ago have done well; so have the Boonoke ewes and rams taken from Australia nearly two years ago.

All horned cattle on the farm are horned branded with numbers and letters. The calves are tagged in the ears till they are fit to brand, which allows of a complete record of the history of each animal being kept. In the case of sheep and goats ear marks and tags are made use of.

At the recent London Tropical Agricultural Exhibition pure Merino wool and fleeces from third and fourth cross native Merino sheep were exhibited, which created a good deal of interest among the visitors.

During the year a number of pure-bred cattle were drafted to Kabete Government Farm, also a number of grade sheep for experiments in a mutton line. Also a number of sheep and goats were sent to the Tana district for grading experiments with native stock.

The breeding of high-class pure-bred cattle and sheep on the farm enables settlers to purchase acclimatised animals at a cheaper rate than they could in most cases import them.

Although the rains have been good during the year under review, the grass hay cut was not up to average quality, being coarse and strong; but a heavy crop was reaped.

An area of flat land on the Lake front is now being cultivated. Twenty-five acres is being laid down under lucerne, and it is the intention to put about 100 acres under cultivation of other crops for the supply of supplementary food for the stock and also posho for the labourers. And it is hoped that most of this food, which has hitherto been purchased, will be produced on the farm.

There are also 30 to 40 acres under cultivation near the homestead. This area is annually put under maize, which, if the season is dry, is made into ensilage.

The erection of a small power engine and a mealie mill has proved a great convenience, allowing of whole maize being purchase and ground into meal and supplied fresh as required.

I have the honour to be,

Sir,

Your obedient servant,

(Signed) N. A. MCGREGOR,

General Manager.

ANNUAL REPORT
OF THE
GENERAL MANAGER
NAIROBI EXPERIMENTAL FARM, KABETE
FOR THE YEAR,
1913-1914.

DEPARTMENT OF AGRICULTURE,
NAIROBI EXPERIMENTAL FARM,
KABETE,
June, 1914.

TO THE HONOURABLE
THE DIRECTOR OF AGRICULTURE,
NAIROBI.

SIR,

I have the honour to submit the sixth annual report upon this farm for the year ending 31st March, 1914.

Weather.—This year has not been favourable. A shortage of rain has to be recorded during both seasons, but especially during the second season.

(Table A.—Meteorological.)

Latitude :— 1°14' 30.94"; S; Longitude :— 36°43' 31.78"; E; Height above sea level :— 6,000 feet.

Month	Inches Rainfall	Highest Rainfall	Date of Highest Rainfall	No. of Days with 0.01" or over	Average Maximum Tempera- ture	Average Minimum Tempera- ture	Average Dry Bulb	Average Wet Bulb	Average Ground Thermometers	
									4 Feet	1 Foot
April ☐ 1913	3.84	0.96	2nd	21	72.7	56.2	61.4	57.2	69.7	68.2
May " "	5.14	1.40	2nd	25	71.3	55.5	60.8	56.2	69.3	67.7
June " "	3.02	1.14	3rd	13	68.3	51.5	58.6	54.4	69.0	66.0
July " "	0.06	0.04	3rd	3	68.5	47.6	55.2	51.2	67.7	65.0
August " "	1.12	0.49	13th	8	70.0	48.0	56.9	55.1	67.7	64.8
September " "	0.14	0.06	16th	5	77.0	50.2	60.9	53.6	69.2	70.3
October " "	2.92	1.04	5th	10	76.7	53.8	62.6	57.6	70.7	70.6
November " "	2.20	0.59	29th	15	73.7	54.6	62.6	59.1	70.3	68.8
December " "	2.13	0.44	13th	11	75.5	51.3	65.0	58.7	69.9	68.9
January 1914	4.02	1.65	31st	16	74.1	53.6	63.2	60.3	69.2	67.4
February " "	0.36	0.36	5th	1	78.8	51.3	67.2	59.3	70.3	72.1
March " "	9.09	3.08	9th	15	77.0	56.0	64.8	60.3	71.7	71.9
Total ...	34.04	...	...	143	73.6	52.5	61.6	56.9	69.5	68.5

Table B. (Meteorological.)

	1910-1911	1911-1912	1912-1913	1913-1914
Rainfall	31.67"	54.34"	51.17"	34.04"
Number of days with rain	129 May:—	143 February— 13.90"	148 April:— 12.19"	143 March:— 9.09"
Wettest Month, with rainfall	5.96"			
Mean:—Dry Bulb	63.6	61.9	62.1	61.6
Mean:—Wet Bulb	56.3	56.8	57.6	56.9
Mean:—Maximum Thermometer	72.8	73.5	72.6	73.6
Mean:—Minimum Thermometer	50.1	51.6	51.7	52.5
Mean:—Ground Thermometer, 4 feet	...	...	69.3	69.5
Mean:—Ground Thermometer, 1 foot	...	...	68.3	68.5

A knowledge of the conditions prevailing during the year can be seen at a glance from the above tables.

One violent rainstorm occurred on March 9th, 1914, when 3.08 inches fell, and, with this exception, no rain fell in such quantity as to do damage to crops or displace the soil. The effect of the storm on March 9th was accentuated by the fact that it was preceded by 1.46 inches on the 8th, and 1.50 inches on the 7th, making a total of 6.04 inches in three days.

The rainfall during the first season was just sufficient to give us a return from the crops, but the second season must be reckoned a failure, as the rain which came in January was too late to be of any value.

The highest temperature for the year occurred on the same day as last year—February 27th—when 85 degrees in the shade was recorded on the maximum thermometer. Our lowest temperature this year was on August 1st, when 36.5 degrees was registered on the minimum thermometer. This last temperature is a record since readings have been taken on the farm. All the effects of frost on the crops in the valleys was noticed.

Cultivation.—The area under cultivation continues as in last report. An area of 10 acres of *paspalum* is being laid down as opportunity permits. Ten acres of black wattle have been planted to provide us with some fuel on the farm.

Coffee.—Eight acres of this crop are now in bearing and being picked. Particulars will be available next year. Certain portions will be manured, and spraying will be started. The coffee is situated on a slope, and, as it seems we have to reckon with at least one severe rainstorm each year, we shall have to put in trenches to prevent washouts.

Fruit Orchard.—Last year I gave a list of the varieties of citrus tree which appeared to have done well here.

That list, with few exceptions, remains as stated. The trees have all borne this year very heavy crops. They have been irrigated during the dry season and the crop thinned. It can be said that the flavour of the fruit has improved this year.

Apples and pears continue to be of slow growth, but the Japanese plum trees carried an immense crop during January, more especially the varieties known as October Purple and Satsuma.

Fly did not do the plums so much injury this year as last, but we are still endeavouring to find a certain remedy for the worm in the oranges.

Linseed.—Eleven acres of this crop were planted out during the first season. Five acres, planted in March, 1913, and harvested in July, yielded at the rate of:—254 lbs. seed, 52 cwt. of straw, and 638 lbs. of fibre per acre. Six acres planted in April and harvested in July yielded:—496 lbs. seed, 52 cwt. of straw, and 613 lbs. of fibre per acre.

The percentage of fibre to straw works out at 10.5 per cent.

Samples of the fibre produced here were sent home and reported on by the Imperial Institute as follows:—

SAMPLE I.—Fibre from straw not laid by rain. The fibre was lustrous, fairly soft, well cleaned and prepared, and almost free from “shieve.” The colour was slightly irregular, varying from a light brownish-grey to a somewhat darker brownish or greenish-grey.

The strength was irregular, but, on the whole, good. Staple length varied from 2 ft. to 3 ft. 4 ins.; mostly 2 ft. 9 ins.

Commercial Value.—£56 per ton (April, 1914). This flax was of very satisfactory quality, although somewhat dark in colour.

SAMPLE II.—Fibre from straw not badly laid by rain. The fibre was soft and lustrous, fairly well cleaned and prepared, and contained only a small quantity of “shieve.” It was darker than Sample I, the colour being dark brownish or greenish-grey. The strength of the greater part was good, whilst that of some portions was poor. Staple length varied from 2 ft. to 3 ft. 4 ins. mostly about 2 ft. 8 ins.

Commercial Value.—£48 to £50 per ton (April, 1914).

The flax was of good quality, but its value was reduced by its dark colour and uneven strength.

SAMPLE III.—Fibre from straw badly laid by rain. The fibre was slightly harsh, moderately lustrous, and fairly well cleaned and prepared, containing only a very small proportion of “shieve.” The colour was dark brownish to greenish-grey. The strength, on the whole, was rather poor. The length of the staple varied from 18 ins. to 2 ft. 11 ins., and was mostly 2 ft. 2 ins. A good deal of short towy fibre was also present.

Commercial Value.—£40 per ton (April, 1914).

The value of this flax was reduced by its weak and rather towy nature, and by its dark colour.

Sample I. was reported saleable in any quantity in the United Kingdom. A good market existed for samples II. and III.

All samples are superior to Russian flax and more comparable with Belgian kinds. Prices for flax reached their lowest in March this year, and are likely now to rise.

Lucerne.—An area of five acres, planted in 1909 and 1911, gives us regularly a large quantity of green fodder. It has been cut three times during the year and fed to the pigs and cattle.

Maize.**MAIZE VARIETY EXPERIMENTS.**

FIRST SEASON.—AREA, 34.47 ACRES.

Variety.	Planted.	Duration.	Harvested.	Yield per Acre.
	1913	About	1913	
Iowa Silver Mine ...	25th March	6 months.	12th Sept.	670 lbs.
Hickory King ...	22nd Feb.	do	3rd "	807 "
Yellow Hogan ...	24th April	do	24th Nov.	679 "
100—Days Bristol ...	26th March	do	5th Sept.	1081 "

SECOND SEASON.—AREA, 66.25 ACRES.

30.75 Acres used as Green Fodder.

Variety.	Planted.	Duration.	Harvested.	Yield per Acre.
	1913	About	1914	
100—Days Bristol ...	23rd Oct.	6 months	25th April	762 lbs.
Champion White Pearl ...	24th "	do	27th "	630 "
Iowa Silver Mine ...	24th "	do	7th "	1715 "
Chester County Mammoth	27th "	Used as green Fodder to Cattle.		
100—Day Bristol ...	27th "	do do	do	do
		About		
100—Day Bristol ...	27th "	6 months.	27th May	438 lbs.

The yields of the varieties of maize are affected greatly by the small rainfall.

The second season's crop was very largely used for feeding to the cattle—green—owing to the dearth of grass.

Beans.**BEAN VARIETY EXPERIMENT.**

FIRST SEASON.—AREA, 14 ACRES.

Variety.	Planted.	Duration.	Harvested.	Yield per Acre.
	1913	About	1913	
Rose Coco ...	12th May	4 months	19th Sept.	755 lbs.
Butter ...	"	do	11th "	566 "
Stringless ...	"	do	11th "	696 "
Canadian Wonder ...	15th May	do	18th "	674 "

SECOND SEASON.—AREA, 18 ACRES.

Variety.	Planted.	Duration.	Harvested.	Yield per Acre.
	1913	About	1914	
Canadian Wonder ...	14th Nov.	4 months.	28th Mar.	260 lbs.
Rose Coco ...	14th "	do	17th "	541 "
Butter ...	13th "	do	14th "	480 "
Stringless ...	13th "	do	4th "	678 "
Praila Flat White ...	13th "	do	3rd "	426 "
Noyau au Blanc ...	13th "	do	2nd "	186 "

The beans are not affected by drought to the same extent as maize, and the yields, in most cases, are satisfactory.

Peas.

FIRST SEASON.

Variety.	Planted.	Duration.	Harvested.	Yield per Acre.
	1913	About	1913	
Telephone ...	12th May	4 months	1st Sept.	384 lbs.
American Wonder ...	12th May	do	1st Sept.	480 "
SECOND SEASON.				
	1913	About	1914	
Stratagem ...	13th Nov.	4 months	14th March	415 lbs.
American Wonder ...	13th Nov.	do	14th March	344 "

The yield from the peas this year is fair, and the sample of seed is good.

Wheat.—No attempt at growing wheat on a field scale was made this season as rust is very prevalent. One acre of "Thew" planted in April and harvested in September, 1913, yielded 304 lbs. wheat. Two acres of the same variety, planted in November, 1913, and harvested in March, 1914, yielded 312 lbs.

Rust, although present, has not yet affected this variety so much as to make it not worth while to grow it. Very many varieties have been tried on a small scale in the Nursery, but we have not yet been successful in producing a rust-resistant variety.

Barley.—One acre of a new variety from Wisconsin, planted on 16th May and harvested on 30th September, 1913, yielded 559 lbs. of seed. An area of 5 acres was planted in November, 1913, and harvested in March, 1914, but drought very seriously affected the yield, and we only managed to harvest 620 lbs.

Potatoes.

EXPERIMENT WITH POTATOES—FIELD CROP.

FIRST SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.			
	1913.	1913.	Tons. Cwts. Qrs. Lbs.			
British Queen ...	25th March.	14th Sept.	1	11	2	2
Scottish Triumph ...	"	"	1	16	3	9
Early Rose ...	"	"	1	17	0	8
Abundance ...	"	"	1	6	2	19
Up-to-Date ...	"	"	1	9	0	10
British Queen ...	12th March.	"	1	14	1	13
Duchess of Cornwall ...	"	"	2	1	0	7
Scottish Triumph ...	"	"	2	0	0	24
Ninetyfold ...	"	"	1	5	2	9
Epicures ...	"	"	2	11	2	27
Early Regent ...	"	"	1	7	1	26
May Queen ...	"	"	1	17	1	20
Factor ...	"	"	1	14	3	8
King Edward ...	"	"	0	6	3	4
Midlothian Early ...	"	"	1	2	2	21
Ideal ...	"	"	0	14	2	5
Langworthy ...	"	"	3	2	1	8
Up-to-Date ...	"	"	1	13	0	24

SECOND SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.			
	1913.	1914.	Tons. Cwts. Qrs. Lbs.			
Factor ...	9th Oct.	29th March.	1	5	3	8
Early Regent ...	"	"	0	10	1	2
May Queen ...	"	"	0	8	0	21
Midlothian Early ...	"	"	0	10	0	24
Up-to-Date ...	"	"	0	13	2	15
Scottish Triumph ...	"	"	0	8	3	1
Duchess of Cornwall ...	"	31st March.	0	13	3	20
Ninetyfold ...	"	"	0	8	1	3
British Queen ...	"	"	0	13	2	15
Langworthy ...	"	"	0	17	2	12
Early Rose ...	"	"	0	6	0	7
King Edward ...	"	"	0	18	3	4

All varieties show poor yields, but this was only to be expected from the season. Langworthy gave the best results in both seasons.

The tables below give the yields on small plots of the same varieties.

EXPERIMENTS WITH POTATOES—SMALL PLOTS.

FIRST SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.			
	1913.	1913.	Tons. Cwts. Qrs. Lbs.			
May Queen	1st April.	14th Oct.	8	19	0	12
Factor	"	"	6	8	2	8
British Queen	"	"	9	13	1	26
King Edward VII.	"	"	2	6	2	12
Scottish Triumph	"	"	4	16	1	20
Early Regent	29th March.	"	6	4	2	6
Early Rose	"	"	4	4	1	14
Duchess of Cornwall	"	"	6	0	2	4
Epicures	"	"	10	6	2	2
Midlothian Early	"	"	5	16	2	2
Up-to-Date	"	"	6	16	2	12
Langworthy	"	"	5	16	2	2
Ninety-Fold	"	"	4	8	1	16

SECOND SEASON.

Variety.	Planted.	Harv.sted.	Yield per Acre.			
	1913.	1914.	Tons. Cwts. Qrs. Lbs.			
Early Regent	7th Nov.	6th Arpil.	1	16	3	24
Midlothian Early	"	"	1	16	0	18
British Queen	"	"	2	0	0	20
Factor	"	"	2	11	1	20
Scottish Triumph	"	29th May.	1	8	3	20
Epicures	"	"	1	12	0	16
Up-to-Date	"	"	1	18	2	8
Langworthy	"	6th April.	1	10	2	4
King Edward VII.	"	"	2	0	3	26
Ninety-Fold	"	"	1	18	2	8
May Queen	"	11th April.	2	17	3	14
Early Rose	"	"	2	0	0	20
Duchess of Cornwall	"	"	3	0	1	2

EXPERIMENTS WITH WHEAT VARIETIES.

FIRST SEASON.

Variety.		Planted.	Harvested.	Yield per Acre.
		1913.	1913.	
White Egyptian	...	15th April.	17th Oct.	270 lbs.
Cross 4/5/3a.	...	"	25th Sept.	450 "
" 4/5/3b.	...	"	"	405 "
" 4/5/2a.	...	"	"	158 "
" 4/5/2b.	...	"	"	225 "
" 4/5/1a.	...	"	10th Sept.	315 "
" 4/5/1b.	...	"	"	450 "
" 17/5/6	...	"	25th Sept.	765 "
" 10/12/9	...	"	10th Sept.	68 "
" 10/12/11	...	"	25th Sept.	315 "
" 10/9/2	...	"	Rusted.	Rusted.
" 15/3/1	...	"	25th Sept.	382 lbs.
" 15/3/6	...	"	"	506 "
" 15/3/8	...	"	"	698 "
" 15/4	...	"	Rusted.	Rusted.
" 15/5	...	"	25th Sept.	225 lbs.
" 12/3/2	...	"	"	990 "
Pusa No. 101	...	17th April.	Rusted.	Rusted.
" No. 106	...	"	25th Sept.	90 lbs.
" No. 6	...	"	"	450 "
" No. 12	...	"	"	90 "
" No. 1	...	"	Rusted.	Rusted.
" No. 4	...	"	"	Rusted.
" Hybrid, 8a.	...	"	25th Sept.	112 lbs.
" Hybrid, 8d.	...	"	"	180 "
Cross 2/1	...	"	Rusted.	Rusted.
" 12/10	...	"	25th Sept.	315 lbs.
" 13/17/4	...	"	"	304 "
" 13/17/5	...	"	"	371 "
" 13/17/6	...	"	"	169 "
" 14/5/4	...	"	"	371 "
" 13/17/1	...	"	"	338 "
" 13/17/2	...	"	"	276 "
Biffin 119/2	...	16th April.	Rusted.	Rusted.
" 119/25a.	...	"	"	"
" 125/B.	...	"	"	"
Thew	...	"	Destroyed by	Rust and Birds.
Usher's	...	"	"	"
Biffin 119/26	...	17th April.	Rusted.	" Rusted.
" 119/29	...	"	"	"
Pusa	...	"	25th Sept.	293 lbs.
Persian	...	"	Rusted.	Rusted.
White Egyptian, E. 1/8	...	28th May.	27th Sept.	33 lbs.
" E. 3/17	...	"	24th Oct.	90 "
Biffin 119/50	...	17th April.	Rusted.	Rusted.
" 119/52	...	"	"	"
Type 17	...	17th May.	14th Oct.	495 lbs.
Warren	...	"	"	382 "
Thew	...	"	"	483 "
White Loaf	...	"	"	405 "
Selected I. M. Rieti	...	"	"	303 "
Barley Wheat	...	29th April.	"	45 "
Rye, Type 8	...	"	17th Oct.	652 "
White Egyptian, E.4	...	24th May.	24th Oct.	630 "

SECOND SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1914.	
Cross 4/5/6	7th Nov.	14th March.	180 lbs.
„ 13/17/4	„	„	247 „
Pusa, 12	„	„	371 „
Cross 4/5/3a.	„	„	270 „
Cross 4/5/2a.	„	„	272 „
„ 15/3/1	„	„	180 „
„ 13/17/6	„	„	157 „
„ 15/3/6	„	14th April.	360 „
Pusa, No. 6	„	25th Feb.	268 „
Cross 13/3/8	„	14th March.	315 „
„ 14/5/14	„	„	33 „
White Loaf	„	„	78 „
Fourie	„	„	102 „
Upper Cut	„	Failure.	Failure.
Cross, 17	„	„	„
Selected I. M. Rieti	„	„	„
Thew	„	„	„
White Egyptian, E/1/a.	„	„	„
Type 8	„	„	„
Warren	„	„	„
Bobs	27th Nov.	Rusted.	Rusted.
Red Fife	„	„	„
Type 22	„	„	„
Polish	„	„	„
Prussian	„	Failure.	Failure.

A large number of wheat varieties were tried, and the results are varied. Many other crosses were planted by the Acting Cerealist. It is yet too soon for us to form any authoritative opinion about the possibilities of the varieties in hand and in the making.

Maize.

EXPERIMENT WITH MAIZE VARIETIES.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1913.	
White Capped Dent			
Minnesota No. 23 ...	31st March.	15th Aug.	450 lbs.
Quebec Yellow Flint ...	4th April.	„	630 „
Champion White Pearl ...	12th April.	14th Oct.	1800 „
Improved Yellow Dent ...	15th April.	2nd Sept.	90 „
Minnesota No. 13 ...	„	„	180 „
Hall's Hybrid ...	17th March.	10th Sept.	2700 „
	1913.	1914.	
Quebec Yellow Flint ...	13th Nov.	14th March.	360 „
Hall's Hybrid ...	„	Failure.	Failure.
White Capped Dent ...	„	14th April.	450 lbs.
Improved Yellow Dent ...	15th Nov.	„	495 „

„ Hall's Hybrid ” is a local cross, and is a nice white mealie, but its period of growth is rather long for this district.

Beans.**EXPERIMENT WITH BEAN VARIETIES.****FIRST SEASON.**

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1913.	
Langbohnen	16th May.	11th Sept.	810 lbs.
Schmalzbohnen	"	23rd Sept.	720 "
French Coco	"	"	270 "
Rose Coco	"	"	990 "
Noyau au Blanc	"	11th Sept.	945 "
Flagelot	"	23rd Sept.	1215 "
Butter	"	11th Sept.	1440 "
Canadian Wonder	"	"	1620 "
Horse	28th May.	24th Oct.	337 "
Large Flat	16th May.	4th Nov.	540 "

SECOND SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1914.	
Schmalzbohnen	14th Nov.	9th March.	360 lbs.
Noyau au Blanc	"	"	405 "
Langbohnen	"	"	472 "
Butter	"	"	360 "
Canadian Wonder	"	"	540 "
Flagelot	"	"	470 "
White Cocos	"	"	495 "
Horse	"	"	360 "
Large Flat	"	Destroyed by rain.	

Beans continue to give good results, and in time ought to be an important crop in this country, when grown in bulk.

Peas.**EXPERIMENT WITH PEAS, ETC.****FIRST SEASON.**

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1913.	
Chick	8th April.	Failure.	Failure.
Lentils, Egyptian	5th April.	23rd Sept.	1170 lbs.
Lentils, Indian	"	24th Oct.	697 "
American Wonder	"	22nd July.	630 "
Telephone	"	2nd Sept.	968 "
Peerless	"	"	495 "
Small Field	"	"	765 "
Stratagem	"	23rd Sept.	655 "
Sutton's Marrowfat	7th June.	25th Sept.	248 "

SECOND SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1914.	
Small Field	15th Nov.	14th March.	495 "
American Wonder	"	19th Feb.	247 "
Telephone	"	Failure.	Failure.
Telephone	18th Nov.	14th March.	315 lbs.
Marrowfat	"	"	135 "
Stratagem	15th Nov.	12th March.	135 "
Lentils, Egyptian	5th Dec.	14th March.	270 "
Lentils, Indian	"	Failure.	Failure.
Gram, Indian	"	"	"

The pea crop is one worthy of attention, along with beans, as an alternate crop to maize, and, as shown above, seldom yields unsatisfactory results.

Mildew attacked some of the varieties, but not seriously.

Barley.

EXPERIMENTS WITH BARLEY VARIETIES.

FIRST SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1914.	
Webb's Burton Malting	8th April,	14th Oct.	270 lbs.
Wisconsin, Ped.	"	2nd Sept.	720 "

SECOND SEASON.

Variety.	Planted.	Harvested.	Yield per Acre.
	1913.	1914.	
Hooded	14th Nov.	14th March.	56 "
Wisconsin, Ped.	"	Failure.	Failure.
Abyssinian Inat	27th Nov.	"	"

The Wisconsin pedigree variety, recently imported, has yielded fairly well this year. It requires a certain amount of rain at the beginning of its growth, and if this fails the crop is apt to stand still.

This happened during the second season, and we have no result from that season.

Roots.**EXPERIMENTS WITH ROOTS.**

Variety.	Planted.	Harvested.	Yield per Acre.			
	1913.	1914.	Tons. Cwts. Qrs. lbs.			
Mangels, Yellow Globe ...	16th Sept.	23rd May.	21	17	3	22
Sugar Beet, Half Rose ...	"	18th May.	43	3	3	10
Sugar Beet, White ...	"	23rd May.	17	15	0	20
Mangels, Long Red ...	"	18th May.	59	10	3	16
Mangels, Yellow Inter. ...	"	"	41	19	2	26

The Long Red Mangel, as in past seasons, continues to give the highest yield. We have not been quite successful, so far, in securing a field crop by sowing the seeds in drills as is usually done in ordinary farm practice. An attempt will be made at transplanting to the field after growing the plants in seed beds.

Rotations.

I give beneath the results of some rotation experiments we have been carrying out here. They are, in the main, four course, and under ordinary conditions would be spread over four years. The results obtained are, therefore, having regard to our double season, for two years ending March, 1914. These will be continued, and as time goes on variations may be tried or additions may be made. The main object has been to devise some easily worked, simple and yet effective succession of crops on the same ground.

Farmyard manure is not yet available for everyone, neither is a regular and economical supply of the various artificial manures. The use of the latter is not likely to be so profitable on farms with virgin soil at this date, as it will be later. Therefore I have not yet introduced any complicated system of manuring into ordinary farm crops, but the coffee here is rapidly reaching a stage when we shall be able to apply various manures to it. The trees will be three years transplanted when we begin in April, 1915. Complete results from these, naturally, will not be available for some years, but the process will be going on and certain deductions will be possible from time to time.

Maize, beans and wheat have been taken as those crops most likely to be grown on a large scale presently. They are not crops yielding large profits per acre, but they give returns sufficiently profitable to warrant their growth over large areas in many parts of the Protectorate.

Linseed and tobacco have been included. These are crops requiring special knowledge and special conditions. On this farm, the results obtained from the growth of linseed can be said to be very satisfactory, and it is an adaptable plant.

This cannot be said of tobacco, and, while the dried weight of leaf is given, I regret that, owing to the absence of a local market for the rough product, no reliable value can be put on the return. Where the soil is lighter and more sandy this crop will be more suitable in a rotation than it is here; at least, until we have discovered a variety adaptable to our soil.

Rotation "H" underneath may not appear to some to have any practical value, but it has an academic one, and it affords a comparison with Rotation "I." It has had no manure applied of any description, and this would, ordinarily, be bad practice.

ROTATION TABLES.

Crop.	Planted.	Harvested.	Yield per Acre.
ROTATION "D."			
Maize	Apl. 5, 1912.	Oct. 3, 1912	1799 lbs
Beans	Nov. 18 1912	Feb. 26 1913	1147 "
Potatoes	Apl. 4, 1913.	Sept. 27 1913	Tons. Cwts. Qrs. Lbs. 9 3 1 5
Fallow			
ROTATION "E."			
Maize, manured with 20 tons farmyard manure	May 5, 1912.	Oct. 3, 1912.	1993 lbs.
Wheat	Nov. 18 1912	Apl. 21, 1913	1237 "
Potatoes	Apl. 24, 1913	Sept. 27 1913	Tons. Cwts. Qrs. Lbs. 5 15 3 26
ROTATION "F."			
Barley	Apl. 13, 1912	Sept. 14 1912	323 lbs.
Beans	Nov. 18 1912	Feb. 26 1913	1106 "
Maize	Mar 28, 1913	Sept. 27 1913	1650 "
Fallow			
ROTATION "G."			
Tobacco	May 5, 1912	Aug 30, 1912	799 lbs.
Beans	Nov. 18 1912	Feb. 26 1913	1145 "
Maize, manured with 200 lbs. Superphosphate	Mar. 28 1913	Sept. 27 1913	1470 "
Barley	Nov. 13 1913	Apl. 15, 1914	353 "
ROTATION "H."			
Tobacco	Apl. 5, 1912	Sept. 4, 1912	915 "
Beans	Nov. 18 1912	Feb. 26 1913	1025 "
Maize	Mar. 28 1913	Sept. 27 1913	1260 "
Linseed	Oct. 30, 1913	Feb. 23 1914	315 "
ROTATION "I."			
Tobacco	Apl. 5, 1912	Sept. 4, 1912	843 "
Beans	Nov. 18 1912	Feb. 26 1913	1215 "
Maize, manured with 20 tons farmyard manure	Mar. 28 1913	Sept. 27 1913	1620 "
Linseed	Oct. 30, 1913	Feb 23 1914	337 "

The linseed was a comparative failure in the Rotations " H " and " I." This crop requires about ten inches of rain the first two months after planting, else it remains stunted, and does not yield a plant fit for fibre. The quantity of seed is very small.

It is unfortunate that we should have had such a small rainfall (5 ins. spread over 27 days) as the continuity of our experiment is spoiled to a certain extent.

The effect of manuring is noticeable, but not to the extent I expect it will be in the future, as in all cases in this report, for the sake of convenience, it has been applied late in the rotation.

A fallow season has been introduced in rotations " D " and " F," and an estimate of its effectiveness or otherwise in this climate will be got.

Experiments with Various Crops.

PABPALUM DILATATUM.—This grass continues to show its undoubted value as a forage grass. It is in great demand by the cattle. A further area has been planted.

It yielded when cut green, this year, eight tons to the acre.

TEFF GRASS (*Eragrostis abyssinica*) is a vigorous grass and yields a nice crop of hay in a short time.

An area planted on 16th May and cut on 11th September, 1913, yielded 3 tons 13 cwts. of fodder, including 945 lbs. seed per acre. Another plot, planted on 18th November, 1913, and harvested on 24th February, 1914—in a dry season—gave at the rate of 1 ton 13 cwts. of fodder and 467 lbs. seed per acre.

SCHRADER'S BROME GRASS (*Bromus Schraderi*) has been tried, but it is not to be recommended.

TALL OAT GRASS (*Arrhenatherum avenaceum*) grows, but is unsatisfactory.

YARROW (*Achillea Millefolia*) seems to occupy the ground well, but is not likely to be of much use at present.

BURNET, SAINFOIN, TOOWOOMBA CANARY GRASS, SULLA, AND WOLTH'S GRASS have all grown well.

GROUND NUTS (*Arachis hypogæa*) grow very successfully.

ARROWROOT (*Maranta Arundinacea*) seems to grow luxuriantly. We hope to know next year what possibilities it possesses.

JERSEY KALE.—This has grown luxuriantly, and gives promise of great feeding value.

BROOM CORN (*Panicum crus-galli*).—This plant, from which the ordinary carpet broom is made, has been grown from the very best Illinois seed. An area of three acres was planted out during the first season, and one of five acres during the second season.

The crop is a very fine one, and it looks as though its cultivation on a commercial scale might be undertaken.

Pests.—Birds have been present in great numbers.

Pupils.—Seven pupils were in residence on the farm during the year under review.

Labour.—We have had Kavirondo boys during the year, as it seems Nairobi absorbs all our former supply.

Several Kavirondo chiefs visited the farm and expressed themselves willing to supply all the labour we wanted from time to time. These boys are indentured for a six months' stretch, and one source of worry has been removed to a certain extent.

Live Stock.

One mare dropped a colt foal to "Royal Fox."

The filly foal of the mare suffering from lymphangitis has grown into a fine animal. The mare herself has been sent to the Laboratory for treatment.

One mare died at Naivasha from tick fever.

The South Devon Cow calved a heifer calf, as also did the Red Poll cow. The young bull from the South Devon cow is now fourteen months old, and has every appearance of turning out a useful animal. In March seven Ayrshire heifers (calves), bought when I was at home on leave, arrived, and all have thriven well.

Dipping was commenced in October. Before dipping commenced 26 head of stock of all kinds had died from East Coast fever. Five were poisoned by spraying and four died from poisoning after the dip was started.

SHEEP.—Fourteen sheep succumbed to Nairobi Sheep Disease, pneumonia, etc.

ELAND.—The old bull eland died, but the two calves have grown into nice animals.

PIGS.—There have been no deaths among the pigs from disease. Three were aged and destroyed, and two young ones were poisoned by the dip.

DONKEYS.—The remaining first cross stallions were sent to Naivasha and sold at the annual sale.

The following stock were despatched from the farm during the year:—

Pigs, 82; Cattle, 14; Sheep, 26; Donkeys, 3; Mules, 2; Horse, 1. Total, all classes—128.

Stock on Hand.

The farm was carrying at the end of the year:—

Cattle	...	...	...	327
Sheep	...	...	...	49
Horses	...	...	...	3
Mules	...	...	...	7
Pigs	...	...	...	86
Eland	...	...	...	4

Visitors.—Visitors, including many new arrivals and a fair proportion of residents, have been coming almost daily at certain seasons.

Staff.—I was absent on leave from the end of November until the middle of May, and Mr. W. J. Dawson was acting manager.

Mr. W. McNaughtan, my assistant, has carried out his duties in his usual efficient manner, and Mr. J. D. Ritchie, as clerk has been of great assistance in tabulating our many records accurately.

Mr. R. Dedonckele, in charge of the linseed and flax, has been busy exploiting this industry.

Mr. J. J. Adams arrived in January, and will do all he can to forward the fruit industry.

I have the honour to be,

Sir,

Your obedient servant,

J. JOHNSTON, *Manager.*

ANNUAL REPORT

ON THE

TOBACCO DIVISION

FOR THE

YEAR ENDING 31ST MARCH, 1914.

THE TOBACCO DIVISION,
AGRICULTURAL DEPARTMENT,
NAIROBI, B.E.A.
1st April, 1914.

THE HON. DIRECTOR OF AGRICULTURE.

SIR,

I have the honour to submit my third annual report.

During the year the greater part of my time was spent at my headquarters, the Government Farm, Kabete, the remainder in visits to the following centres and districts:—Nairobi, Kibos, Muhoroni, Njoro, Rongai, Lower Molo, Nakuru, Thika, Mua, Lukenia, Makindu, Kibwezi, Rabai, Mombasa.

A young European was engaged for a portion of the season to superintend the labour at Kabete during my absence.

The understated tobacco trials have taken place:—

(1) Government Farm, Kabete.

Planting was begun on 3rd April and continued to 18th June from seed beds sown the previous February and March. The plots were:—

No.	Variety.	Source of Seeds.	Area in acres.	Specing of plants in ft. and ins.	Net yield baled leaf in lbs.
1	Sterling ...	1st crop Kabete	$\frac{1}{2}$	3'0" x 3'6"	148
2	Sterling Bright ...	U. S. A.	$\frac{1}{2}$	3'0" x 3'6"	349
3	Kentucky Yellow ...	U. S. A.	$\frac{1}{2}$	2'6" x 3'6"	204
4	Yellow Mammoth ...	U. S. A.	$\frac{1}{2}$	3'0" x 3'6"	140
5	Hyc ...	U. S. A.	$\frac{1}{2}$	3'0" x 3'6"	105
6	Lacks ...	U. S. A.	$\frac{1}{2}$	3'0" x 3'6"	116
7	White Stem Oronoko...	U. S. A.	1	2'6" x 3'6" 3'0" x 3'6"	
8	Raglands Improved				
	Oronoko, Yellow ...	1st crop Kabete	$\frac{1}{2}$	3'0" x 3'6"	
9	Goldfinder ...	do	$\frac{1}{2}$	3'0" x 3'6"	
10	Hester ...	do	$\frac{1}{2}$	3'0" x 3'6"	
11	Cavalla ...	Turkish	1/10	0'8" x 2'0"	
12	Smyrna ...	Turkish	3/20	0'8" x 2'0"	

These plots failed so yields were not taken.

The plots were all divided one from another by windbreaks.

The season did not prove favourable. Only 13.18 inches of rainfall was recorded during the planting and growing months, April to August inclusive. Also the weather was very much colder than in the corresponding season of 1912. Readings of the dry bulb thermometer at Kabete during these five months show an average lower temperature by 2.73 degrees F. The result of these conditions was that the greater proportion of the plants never grew out properly. The only plots to show a reasonable yield were Nos. 1 and 3, which were planted early. A very small quantity of leaf fit to reap was produced on plots Nos. 7 to 12.

The cut-worm again did considerable damage, and experience shows that the only practical remedy at present known is to dig out the worms by hand.

Various sprays were tried to combat insect and fungus pests with good results, except that it was found impossible to keep the "white mildew" in check on the Turkish tobaccos, and the whole of the leaf of these varieties was ruined.

Part of the leaf from the above detailed plots was air cured, part sun cured, and a small quantity flue cured. The last did not cure out satisfactorily. It is proposed shortly to ship sample bales of the more promising of these tobaccos to England, to obtain expert opinion on their market value.

Seed beds of eleven varieties were sown (29th August to 20th September), and five acres were planted (27th October to 31st December), but owing to the continued drought the crop was a complete failure. Irrigation was tried, but was not a success.

For the purpose of providing plants for plots during the coming long rains seed beds of the following varieties have been sown:—

(a) Yellow Pryor	}	Seed imported from U.S.A.
(b) White Burley		
(c) Gold Leaf		
(d) White Stem Oronoko		
(e) Kentucky Yellow		
(f) Sterling Bright ...	...	Seed, 2nd crop, Kabete.
(g) Caine's White Stem	...	Seed, 1st crop, Kabete.
(h) White Burley ...	...	Seed, 1st crop, Kabete.
(i) Sumatra	}	Cigar Tobaccos. Seed imported from U.S.A.
(j) Vuelta de Abajo		
(k) Connecticut Seed Leaf		
(l) Pennsylvania Broad Leaf		
(m) Florida Cuban		

SEED.—Seed has been selected and harvested from those plots which did best, and is now available for distribution.

BUILDINGS.—A wood and iron store has been built, and an air curing barn of the same materials for cigar leaf is in course of erection.

REPORT FROM THE IMPERIAL INSTITUTE.—A report on the samples of tobacco grown at Kabete during the year 1912 has been received from the Director of the Imperial Institute, and is being published in the journal of the Department.

The recommendations in the report have considerably guided the subsequent experiments.

CONCLUSIONS.—The results of the trials up to date at Kabete in my opinion show that there is more likelihood of growing a tobacco suitable for air curing than a light type, on the soil of the district. The high altitude is probably the cause of the non success of many of the trials.

(2) Hollins Estate, Kibwezi.

An area of seven acres net was planted out between rows of sisal during the last ten days of March, 1913, from seed beds sown 28th January to 7th February. The growth of these seedlings was remarkably quick in the seed beds, six weeks being ample time to produce plants large enough to transplant in the field, about half the time required to raise seedlings at Kabete.

The varieties planted were:—

- (a) Hester
- (b) Goldfinder
- (c) Yellow Oronoko

Imported American seed.

- (d) Smyrna—Turkish seed.

All the varieties grew out well, and though preparations had been made to irrigate the area it was not necessary to do so.

Later the "white mildew" attacked the Turkish tobacco, and it was pulled out to prevent the pest spreading to the American varieties.

A small quantity of the leaf was sun cured, and the remainder prepared for native consumption. The sun cured leaf is of good quality, an opinion in which I am supported by a well-known tobacco expert who visited Kabete recently and saw samples of the leaf.

This experiment has certainly proved the most successful experiment during the last year, and indicates that the Kibwezi district is suitable for the crop.

(3) Kilimanyota Estate, Kibwezi.

Arrangements have been made for a Government trial area on this estate, and experiments on a small scale with six varieties of tobacco have been started.

The soil differs somewhat from that on which the trial on the Hollins Estate was carried out, and the result should be of great use to planters of the district.

(4) Njoro.

The trials on Lord Delamere's estate were continued on a smaller scale. Probably better results would be obtained if the planting was tried on the lower and more sheltered portion of the estate.

(5) Rongai and Lower Molo.

In this district two flue barns have been built, and considerable interest is shown in the crop. Messrs. Armstrong won the first prize for tobacco leaf at the Nakuru Show with leaf produced on their Rongai plantation.

(6) Muhoroni.

An experiment took place on Mr. C. Harvey's farm. I have only had an opportunity of inspecting the crop in the field, which had grown out well, but I understand the return of leaf when cured was exceptionally large per acre.

At the present time trials have been started under my supervision on Lord Kitchener's estate, and will be continued during the coming year.

(7) Kibos.

A small quantity of White Burley was grown at the Government plantation, Kibos, under the supervision of Mr. Holder. The results were promising, and will be submitted for commercial opinion.

Other varieties will be tried during the ensuing season.

(8) Kamiti Plains.

Mr. B. E. A. O'Meara has been successful in producing tobaccos grown from South African seed on his plantation, and intends to experiment in the future with other varieties.

(9) Other Trials.

It is intended, I am informed, to carry out trials on plantations in the following districts:—Trans Njoia, Uasin Gishu, Nyeri, Thika, Ruiru, Kyambu, Lukenia, Makindu, Gazi, Kismayu.

In conclusion I would state my opinion that when it is found practicable to institute further trials on the light sandy soils of the Protectorate at lower altitudes than the majority of those at present in progress, better results will be obtained.

I have the honour to be,

Sir,

Your most obedient servant,

(Signed) CHRIS. J. MONSON,

Adviser for Tobacco.

ANNUAL REPORT

OF THE

MYCOLOGIST, FOR THE YEAR

1913-1914.

DEPARTMENT OF AGRICULTURE,
NAIROBI.

THE HONOURABLE THE DIRECTOR OF AGRICULTURE,
NAIROBI

SIR,

I have the honour to submit my annual report as Mycologist. The period covered is from my arrival in the Protectorate on April 19th, 1913, to March 31st, 1914.

The most important among the diseases sent to me for investigation was the "bud-rot" of the coconut palm, which occurs on two plantations, one to the north, the other to the south of Mombasa. My investigations of this disease revealed the presence of a bacterium and of a fungus mycelium. Neither organism was identified, but it is obvious that in order to control adequately any given disease one must know the nature and the action of the parasite at work. This is all the more important in this case, for in India a "bud-rot" of coconuts has been definitely proved to be caused by the parasitic fungus *Pythium palmivorum*, while in Ceylon and the West Indies there is much evidence for the view that *Bacillus Coli Communis* is the causative organism. A "bud-rot" disease of coconuts similar, if not identical, with that which occurs in British East Africa, is reported from German and Portuguese East Africa.

The actual investigations made and conclusions reached concerning each disease were dealt with in separate reports, and are not referred to here.

1. Coconut Palms.

On May 10th, 1913, and again from June 26th to July 14th, I inspected a coconut plantation on the M'twapa creek, and investigated, so far as I was able, the "bud-rot" disease. In this connection I also visited a large plantation at Gazi on July 19th to July 21st, 1913, and again on December 13th, 1913. Both areas were cleared of diseased palms, and those which subsequently showed signs of disease were cut down and burned. On July 29th, 1913, I inspected a plantation on the M'wechi River, which contained several thousand Pemba and one thousand Ceylon palms. The latter were part of the original consignment sent to the M'twapa plantation. No "bud-rot" was discovered on this estate.

2. Sisal.

On May 11th to May 14th, 1913, and again on July 11th to July 13th, 1913, I visited a large sisal plantation in the neighbourhood of the Kilifi creek. The investigation showed that the disease is of a physiological nature, probably due to climatic conditions, and is similar to that which occurs in German East Africa.

3. Ceara Rubber.

I inspected some rubber plantations in the neighbourhood of Kibwezi on April 26th to April 29th, 1913, and again on October 21st to October 25th, 1913. One-fifth of the young trees were suffering from a curious blackening of the cortical tissues, and contained no latex. In older examples a mycelium was found, but not identified. The evidence pointed to the conclusion that mixed seed was primarily the cause of the malady. On December 13th I visited a plantation at Miritini, but did not find this complaint.

4. Coffee.

Between the months of May and November, 1913, I visited a number of coffee plantations in the neighbourhood of Nairobi and Kyambu. The leaf disease due to *Hemeleia vastatrix* is spread over the whole of this area, though there are a number of plantations still quite free from this pest. Steps are being taken to map out more accurately the distribution of the disease. Spraying with bordeaux has been carried out on some plantations with good results.

In February, 1914, I visited a plantation at Nyeri, but did not find any signs of the leaf disease.

In January, 1914, I carried out some experiments on the action of varying strengths of formalin on coffee seeds and on the uredo spores of *Hemeleia vastatrix*. The results indicated that a very weak solution was sufficient to kill the rust spores, but at the same time the coffee seeds were retarded in germination. As I was away from headquarters at the time the seeds germinated I am unable to give the exact length of time taken, but between

two and three months would be a fairly near estimate. These experiments are being repeated on a larger scale this year. It may be added that the conditions (soil and climate) are most favourable for the development of coffee, and very unfavourable for the spread of leaf disease.

5. Experimental Wheats.

In October, 1913, I took over the experimental wheats left on the Government Farm at Kabete by Mr. G. W. Evans, and in November, 1913, reaped the plots and cage which he had sown. Amongst these two very good crosses were found, namely, that between Red Fife x Rieti and Yellow Fife x Egyptian 3. At the end of November, 1913, the plots and cage were again sown, but owing to the failure of the short rains in December some of the plots did not germinate.

The experimental wheats on Lord Delamere's estate at Njoro I inspected on September 12th, 1913, on October 14th, 1913, and again on January 11th, 1914. There are some 200 or more varieties of wheat containing about 150 hybrids of the third and fifth generation. The most promising of these appeared to be the crosses Egyptian 3 x Nut Cut, Egyptian 3 x Moulds, Early Rieti x Moulds, and Red Fife x Rieti. Among the type wheats the following were the most promising:—Persian Madonna, Media, and Italian.

Early in 1914 an iron building 30 ft. by 18 ft. was erected on the Government Farm at Kabete for the purpose of storing the experimental wheats.

From February 10th to March 8th, 1914, I inspected the forests around Mount Kenia and on the Aberdare Range, in the company of the Chief Conservator of Forests. A heart rot due to a species of *Fomes* is very prevalent in *Juniperus procera* (East African Cedar).

During the latter part of 1913, in conjunction with the Government Analyst, I carried out experiments on the fermentation of sisal waste. The results, so far, indicate that the sisal waste contains far too little sugar to be of any profitable value. A yeast was isolated from sisal plants, and experiments are to be carried out with sisal waste from the coast lands this year.

During the year economic plants of all descriptions were sent to me for examination. The fungus pests of some of these I was able to identify owing to the fact that the parasite was in the fruiting stages. In those cases in which only the vegetative mycelium was present the want of a laboratory prevented further investigation being undertaken.

I also collected a number of parasitic fungi upon the various crops on the Government Farm at Kabete, most of which I was able to identify.

A herbarium has been started, commencing with the more common flowering plants and larger (bracket) fungi, but it is hoped in time to have a fairly representative flora of the Protectorate.

A list of the parasitic fungi dealt with during the course of the year is appended:—

1. Diseases Identified.

Common Name.	Name of Parasite.
Coffee Leaf Disease	<i>Hemelia vastatrix.</i>
Rusts of Wheat	<i>Puccinia graminis.</i>
Rusts of Wheat	<i>Puccinia glumarum.</i>
Rusts of Wheat	<i>Puccinia triticina.</i>
Rusts of Barley	<i>Puccinia simplex.</i>
Rusts of Maize	<i>Puccinia sorghi.</i>
Rusts of Peaches	<i>Puccinia Pruni spinosæ.</i>
Rusts of Figs	<i>Uredo Fici.</i>
Carnation Rust	<i>Uromyces caryophyllinus.</i>
Rust of Beans	<i>Uromyces appendiculatus.</i>
Rose Mildew	<i>Sphacrotheca pannosa.</i>
Tobacco Mildew	<i>Erysiphe communis</i>
Mildew of Cucumber and Marrow	<i>Erysiphe cichoracearum.</i>
Anthraxnose of Grapes	<i>Gleosporium ampelophagum.</i>

2. Diseases Unidentified.

- (a) " Bud-rot " of *Cocos nucifera.*
- (b) Blackening of stems of *Manihot Glaziovii.*
- (c) Root disease of Young *Juniperus procera.*
- (d) Heart Rot of same due to *Fomes* sp.
- (e) Leaf disease of Citrus Trees, the Lime excepted.

I have the honour to be,

Sir,

Your obedient servant,

W. J. DOWSON, *Mycologist.*

ANNUAL REPORT

ON THE

COFFEE PLANTATIONS

FOR THE

YEAR ENDING 31ST MARCH, 1914.

DEPARTMENT OF AGRICULTURE,

NAIROBI.

7th September, 1914.

THE HONOURABLE DIRECTOR OF AGRICULTURE,

NAIROBI.

SIR.

I have the honour to submit herewith my report for the year ending March 31st, 1914.

I arrived in the Protectorate on first appointment the 14th of January, 1914, and at your request visited a number of coffee plantations in the Nairobi and Kyambu districts.

During the period in question I inspected 38 plantations, comprising an area of some 3,000 acres under coffee, and was well pleased with the prospects and the general appearance of the cultivations.

At first sight the obstacles to coffee growing in this Protectorate would appear small, but a closer observation shows that for successful planting a careful watch must be exercised both for insect pests as well as for fungoid diseases. Among the more dangerous pests may be quoted the Antestia Bug and Cut Worm, and their life histories are under investigation by the Government Entomologist.

The well-known coffee leaf disease *Hemileia vastatrix* is also prevalent among a number of plantations in the Nairobi and Kyambu districts. The serious nature of this fungoid disease is fully realised by the Government, which is exercising every means in its power to check its spread to other districts.

There are a few planters who are spraying, and I am told, with successful results.

To the coffee grower with little, if any, experience of planting, the essential factor to reap a golden harvest appears in his optimistic ideas is the planting of a certain acreage which he can claim to be "under coffee."

Coffee is not, however, a crop that can be looked upon so lightly. The care and attention of the young plant from the nursery stage, the selection of suitable saplings for planting out, the pruning and training of the tree to the bearing stage, and the after treatment of the crop will materially affect the ultimate success, or otherwise, of the industry.

During the forthcoming year, 1914-15, my time will be devoted to instruction in the recognised methods of coffee culture.

In conclusion, I am of the opinion that the coffee industry promises to be one of the most important agricultural undertakings in British East Africa.

I have the honour to be,

Sir,

Your obedient servant,

M. D. LE POER TRENCH,

Coffee Plant Inspector.

ANNUAL REPORT

ON THE

REGISTRATION OF BRANDS DIVISION

FOR THE

YEAR ENDING 31ST MARCH, 1914.

DEPARTMENT OF AGRICULTURE,
REGISTRATION OF BRANDS DIVISION,
NAIROBI,
2nd April, 1914.

THE HON. THE DIRECTOR OF AGRICULTURE.

NAIROBI.

SIR,

I have the honour to submit my report on the above Division of your Department for the year ending March 31st, 1914.

During the period under review I have acted for Mr. W. J. Dawson, while the latter was on leave of absence, and, for departmental convenience, when Acting Manager of the Kabete Farm.

122 Brands have been registered during the year, an increase of 39 on the registration of the previous twelve months.

This figure, although small, is satisfactory, indicating that stock owners recognise the advantage gained by branding stock—as a preventative measure against theft and in facilitating the tracing of stolen cattle.

The total number of Brands now registered in the Protectorate is 508, and taking into consideration the fact that a number of Brands are registered in “partnership,” this figure represents a large proportion of the stock-raising community.

Manufacture of Brands.—The Contractors for the year have carried out their duties with satisfaction to the Department, supplying a good class of article, with despatch, at a reasonable figure.

Brands Directory, 1913-14.—A Brands Directory for the fiscal year, arranged on the system adopted by the Queensland authorities, is now in draft, and will be published in April, 1914.

In conclusion, I should like to mention that with the advancement of the Stock Industry in this Protectorate the exportation of hides will become an item of importance. Careful branding, therefore, cannot be too strongly urged upon stock owners.

It is well known that frequent are the complaints of buyers at the damage done to hides by indiscriminate branding, and such branding will not only affect the exporter financially, but the good name of the country from which the export is made.

I have the honour to be,

Sir,

Your obedient servant,

L. D. CARPENTER,

(for) *Registrar of Brands.*

ANNUAL REPORT

ON THE VETERINARY DEPARTMENT, 1913-1914.

OFFICE OF THE CHIEF VETERINARY OFFICER,
NAIROBI.

March 31st, 1914.

The following constituted the staff of the Veterinary Department during the year 1913-1914.

<i>Chief Veterinary Officer</i>	...	R. J. STORDY.
<i>Deputy Chief Veterinary Officer</i>	...	F. R. BRANDT.
<i>Veterinary Pathologist</i>	...	R. E. MONTGOMERY.
<i>Veterinary Officers (ten)</i>	...	R. EDMONDSON. A. G. DOHERTY. H. H. BRASSEY EDWARDS. F. J. MCCALL. W. KENNEDY. O. DIXON. A. S. LEESE. R. C. WHEELER. W. W. HENDERSON. G. N. HALL.

<i>Assistant to Veterinary Pathologist</i>	...	...	W. KEARNEY.
<i>Chief Live Stock Inspector</i>	...	...	CAPTAIN C. A. NEAVE.
<i>Permit Officer</i>	...	...	J. B. BANKS.
<i>Chief Clerk</i>	...	...	J. W. JOHNSON.
<i>Live Stock Inspectors (five), on temporary engagements.</i>			
<i>Indian Veterinary Assistants (four).</i>			

The following officers proceeded on leave during the year:—

MR KENNEDY	...	...	August 12th.
MR. MCCALL	...	...	December 29th
VETERINARY ASSISTANT SEYD GHULAM HASSAN	...	...	October 13th.

Mr. Broome, who was seconded from the Board of Agriculture and Fisheries for duty in Uganda and the East Africa Protectorate, proceeded to England on May 12th, on completion of his term of service.

The following officers returned from leave :—

MR. BRASSEY EDWARDS ...	...	...	April 18th.
MR. MONTGOMERY ...	...	...	June 14th.

The following officers arrived on first appointment :—

MR. LEESE ...	...	...	June 14th.
MESSRS. HENDERSON, WHEELER and KEARNEY ...			August 6th.
MR. HALL ...	...	...	September 7th

In December last, Mr. Brandt, Deputy Chief Veterinary Officer, was appointed to Nigeria as Chief Veterinary Officer, and left for England on the 29th of that month.

On the request of the Uganda Government, Mr. Hall was seconded for service in the Uganda Protectorate from October 30th till December 19th, to assist its Veterinary Department in combating an extensive outbreak of rinderpest.

Mr. Banks, who was formerly Fencing Inspector and later Acting Quarantine Officer, was appointed Permit Officer on April 1st, 1913.

Under instructions from His Excellency the Governor, I proceeded to South Africa on March 18th, 1913, to attend a conference of Veterinarians, convened by His Excellency the Governor-General of South Africa, to discuss rinderpest and the best measures to be adopted to prevent its spread to the South African Colonies. I was further commissioned to enquire into the dipping of stock for the eradication and suppression of East Coast Fever and other tick borne diseases.

I returned to the Protectorate on May 18th, 1913.

A full account of my visit to South Africa will be found in the report submitted to Government on June 11th.

DISEASES OF CATTLE.

East Coast Fever.

This disease has been most prevalent during the last twelve months in the Nairobi District, Kamasia Reserve and the Kedong Valley. No further outbreaks have occurred on the Uasin Gishu Plateau, and the quarantine imposed on the infected farms there has now been removed.

A solitary case, fortunately within a fenced paddock, occurred at the Naivasha Government Farm. Infection in this case was probably traceable to the experimental paddock erected last year, in which East Coast Fever experiments were carried out. All cattle on the farm were submitted to dipping, and no further cases have occurred.

One case occurred on the Laikipia Plateau at Rumuruti, in a bullock illegally brought from the Meru district. The area over which the animal had grazed was de-stocked and carefully guarded, and the in-contacts placed under observation. No more cases have been recorded.

With the West Kenya District coming under colonization a number of outbreaks of East Coast Fever have been recorded. The farmers of this district have been quick to appreciate the value of dipping, and have placed the disease under control by this measure.

One farmer who purchased a mob of 40 head at a sale at Naivasha brought them to his farm situated within the infected Nairobi District, with the result that thirty-six of them succumbed to East Coast Fever.

The Kedong Valley Syndicate, whose owners have at all time strenuously opposed quarantine restrictions on the chimerical grounds that the ticks responsible for the transmission of East Coast Fever could not live in the Rift Valley, lost over 200 head within a few months.

The experiments carried out at Nakuru and Naivasha have proved that ticks accountable for the propagation of East Coast Fever, as well as other varieties of the family Ixodiodea, complete their life cycles and generate their species in the lavic soil of the Rift Valley.

Out of a mob of 500 cattle obtained as a fine from the Kamasia tribe, 153 head succumbed to East Coast Fever. The survivors were submitted to dipping for six weeks on the confines of the Reserve, were then removed to Nakuru, where they have been regularly dipped every three days for the past three months, with the satisfactory result that no further case of the disease has taken place.

These cattle will shortly be sold by public auction.

There have been 546 head of settlers' cattle admitted to the Kamiti Testing Area during the year. Thirty have died, and 516 have been branded and released as immune animals.

I would point out that the small death rate is due to the fact that nearly all the animals exposed on the area were drawn from districts known to be enzootic to East Coast Fever.

Dipping every three days in an arsenical bath of standard strength having proved a satisfactory and easy method of preventing East Coast Fever, the inoculation for this disease, as suggested by Theiler, has not been proceeded with.

Numerous meetings have been held throughout the Protectorate to discuss a general dipping scheme for the country. The outlines of the measure as set forth in my No. 58.1.13 of July 11th, 1913, have now been adopted practically unanimously by the various farmers' associations, and at the present time between 50 and 60 tanks are in working order or in course of erection—a pleasing number for the short period of twelve months since the inception of the dipping operations.

The main point aimed at is the compulsory dipping of of travelling stock, whereby permits may be granted for the movement of all animals regularly dipped. By the application of this rule the farmer will be enabled to run his transport or move his cattle without endangering them or the stock of his neighbours, while the farmer who does not cleanse his cattle will automatically place his farm in quarantine.

Considerable evidence has already been collected as to the efficacy of dipping for the prevention and eradication of East Coast Fever, and the farmers who are systematically dipping their cattle are well pleased with the results obtained.

Difficulty has been experienced in keeping many of the baths up to standard strength owing to the oxidation of the principal ingredient of all cattle dipping fluids—the arsenite of soda. This compound does not remain stable, but is oxidised and becomes converted into arsenate of soda through the agency of bacterial growth in the dipping tank.

The arsenate of soda does not possess the power of the arsenite to destroy ticks; consequently constant supervision has been necessary to keep the bath up to proper strength.

For the year ending March 31st, 1914, the Government Analyst has analysed 120 samples of dipping fluids.

Provision has been made in the estimates for the ensuing financial year for the appointment of an Assistant Analyst to Mr. Kirkham. This officer's sole duty will be to analyse samples of dipping fluids sent in by farmers, so that the dip will be neither too weak to be inefficacious nor too strong as to endanger the cattle.

There can be no doubt that in a country so grossly tick infested every stock owner should either possess a tank or be given facilities to dip his farm animals, for dipping is the only known, practical method of dealing with tick-borne diseases. In my opinion the erection of a dipping plant is the farmer's cheapest and best method of insurance against loss from these causes.

By dipping, the farmer will not only reduce the losses to a minimum, but he will be enabled to import with confidence the cattle necessary for the up-grading of his herds, from the Umland or the Colonies. He will also be able to take advantage of the large markets of Jubaland and Borana which are now open to him.

The indigenous cattle of these districts form a valuable asset to the cattle industry of this Protectorate, but as they are susceptible to East Coast Fever only the farmer who is in possession of a dipping tank can hope to avail himself of this opportunity of stocking up his holding.

The extensive importations of pure-bred stock which have taken place in South Africa demonstrate that confidence has been restored to the South African farmer, and that he no longer dreads tick borne diseases.

The native population are evincing considerable interest in the dipping of stock. During His Excellency's visit to the Masai Reserve a request was made by the Masai that a dipping tank be erected at Ngong. This tank is now under construction.

Every endeavour will be made to convince the Masai of the efficacy of dipping, and once they see the mortality among their young animals decreased, their active co-operation in the dipping scheme is assured. Further, the Masai herdsmen in the employ of Europeans are now thoroughly acquainted with the advantages of dipping, and they will doubtless retail their experiences to the members of their tribe within the Reserve.

The Government has erected a model dipping plant at Nakuru, and dipping demonstrations for the information of settlers have been carried out there and at Mr. Watson's farm near Nairobi. These demonstrations have helped the farming community to appreciate how simple and safe the dipping operation really is. Once the animals are trained to pass through the tank, large numbers can be dipped in a short time. As many as 326 head have been passed through the Nakuru bath in twenty-three minutes.

There have, unfortunately, been several cases of poisoning of cattle with the arsenical dipping fluid.

By constant usage there is grave danger of familiarity breeding contempt in the handling of dipping compounds, and the farmer is apt to become careless either in the preparation of the bath or in allowing cattle access to the tins containing the dipping fluid. Most dipping preparations contain an alkali which is readily licked by cattle. Too great care, therefore, cannot be exercised in placing all poisonous dipping fluids under lock and key.

There have, of course, been cases of poisoning through animals drinking the fluid when passing through the bath, but these cases are generally traceable either to the animals being dipped before being watered properly, to the sudden immersion of young animals untrained to the operation, or to young and adult cattle being dipped together, with the result that the larger animal is apt to jump on the top of the smaller, and by keeping it immersed longer than would otherwise be the case, the fluid is swallowed.

Great care should be observed in disposing of the carcase of an animal which has succumbed to arsenical poisoning. One case in point might be cited. An owner, who lost a calf through the animal drinking a quantity of dip, handed the carcase over to the natives on his farm for consumption. Like all natives they promptly consumed the stomach and entrails, with the result that eleven of them suffered considerable abdominal disturbance. Prompt antidotal treatment prevented any fatality. It was fortunate that the dinner party consisted of eleven, for had only three or four partaken of the piece de resistance the results might have been disastrous.

For the information of the settler and official communities a pamphlet containing rules to be observed in the dipping of every class of stock is now in course of preparation.

Rinderpest.

Outbreaks of rinderpest have occurred at Ngong, Lower Molo, Escarpment, Nandi Reserve, Masai Reserve, Uasin Gishu Plateau, Suk, Turkana and in the districts of Ravine and Baringo.

The severest outbreak was certainly that which implicated the Nandi Reserve, where the mortality was extremely heavy. It has been estimated that the Wanandi lost between 30,000 and 35,000 cattle from rinderpest within the last two years.

The disease was rife practically over the whole of the Uasin Gishu Plateau, but with the free use of serum the number of deaths did not amount to 5 per cent.

The Elgeyo also suffered severe loss, but so far as I could judge from a visit to this district the disease did not spread far into the Elgeyo Valley. The Kamasia have had the disease rife in some portions of their territory, and from the more northerly portions of Suk and Turkana reports have been received to the effect that rinderpest has also been prevalent there. Verification of these reports, however, has been rendered impossible by the fact that no officer could be spared to carry out a veterinary survey of these districts.

In Masailand this disease has also been prevalent, and reports have been received that large numbers of buffalo have succumbed to the disease.

The outbreaks of rinderpest have thrown a tremendous amount of work on the small veterinary staff, and have been the cause of great anxiety.

It was found necessary to prohibit cattle entering British East Africa from Uganda (with the exception of those used for serum production) unless they had been actively immunised to the disease, since a considerable number of cattle arriving across the border were found to be infected.

During the year 201,148 doses of anti-rinderpest serum have been issued from the Laboratory. A large percentage of this amount has been used in suppressing outbreaks of the disease, and in conferring a passive immunity on trade stock.

By keeping trek animals under the influence of serum it was made possible to keep transport routes open. As passive immunity only lasts over a period of from fifteen to thirty days the operation in practice had to be carried out at fortnightly intervals, causing much extra labour and considerable wastage of serum. The Lumbwa farmers, many of whose holdings are on the confines of large native reserves and were in constant danger of having rinderpest introduced to their farms from the infected native territories, held a meeting in January to discuss the question of double inoculating all the cattle in the district, and a scheme submitted by the Veterinary Department was adopted.

By the double or simultaneous inoculation is meant the injection of rinderpest blood on the one side of the animal and anti-rinderpest serum on the other. By this method an animal is given a mild attack of the disease, which confers lifelong immunity.

It will be remembered that this operation was carried out on two or three farms during the epizootic of 1911, but although the blood for these inoculations was drawn from an animal showing typical clinical symptoms of the disease, and the serum was similar to that prepared to-day, the results in two cases were so unsatisfactory that it was deemed inexpedient to continue this method of immunization.

Since then extensive observations have been made with regard to the field application of the simultaneous method, which had proved satisfactory among animals at the Laboratory, and as a result of these experiments, I felt justified in accepting the Lumbwa farmers' offer that their herds should be subjected to active immunization, and thereby demonstrate to the Protectorate its efficacy.

The transport of the virulent blood to Lumbwa was the next difficulty to be overcome. It was solved by obtaining four susceptible animals from hitherto clean farms in the Rift Valley, and sending these animals to Lumbwa, where they were injected with virulent blood supplied from the Laboratory. On these animals re-acting to the injection they were bled, and the virulent material carried to the various farms where the inoculations were carried out.

A full account of these field operations was made to the Government, a copy of which will be found in the appendices of this report.

The inoculations proved very successful, and the mortality from all causes amounted to 0.6 per cent. It is true that a number of cattle in Lumbwa had passed through rinderpest prior to the inoculations, and this in great measure accounted for the very low mortality, but among the susceptibles, numbering 3,383, the death rate was only 1.09 per cent.

Similar inoculations will be undertaken at Ngong, where a higher susceptibility to the disease exists, and the result of these inoculations will be watched with great interest.

Should the double inoculation prove successful, that is to say, should it be found possible to carry out extensive operations with an approximate loss of 5 per cent., it will constitute an effective method of eradicating rinderpest from British East Africa.

The disease is a very serious menace to the stock industry of the country; it crops up from time to time, and there can be no doubt that it keeps smouldering in the remoter parts of the native reserves, where, although the disease has lost its devastating power, it is conveyed to the susceptible herds in the settled areas either by trade cattle, infected offal or illicit movement of infected stock.

The game also, more particularly eland, giraffe, buffalo, and probably wart-hog, are implicated in the spread of rinderpest. There can be no doubt that large numbers of eland and giraffe succumbed to this disease on the northern borders of the Uasin Gishu Plateau.

Rinderpest is still prevalent in German East Africa, and there also, no sooner has one area been freed of the disease than other centres of infection are reported.

All trade cattle from Borana and the Northern Frontier District are inoculated with Anti-Rinderpest serum before permission is given for their removal into the settled areas, and a similar inoculation is carried out at Lumbwa for all cattle drawn from the Nyanza Province.

To eradicate the disease, general and efficient measures must be undertaken, and the double inoculation is the safest, best and only practical method at our command.

It should be pointed out, however, that if a scheme to inoculate the cattle throughout the Protectorate be undertaken, the operations should be carried out at an early date, for with the extension of dipping, the resistance to red-water and anaplasmosis exhibited by the great majority of the cattle in the country will be reduced, and as it is almost impossible to eliminate the casual organisms of these diseases from virulent rinderpest blood, considerable risk would be run by doubly inoculating animals which have been regularly dipped for a period of eighteen months or two years.

At a Veterinary Congress held at Bulawayo to discuss the question of rinderpest and the danger of its spread to the British Central and South African Colonies, an offer was made by the British East Africa Government to supply anti-rinderpest serum up to an amount of 250,000 doses.

The various Colonies concerned decided to obtain a reserve supply of 180,000 doses of serum from our Laboratory.

Of this amount 85,517 doses have already been despatched. It is hoped that with this reserve of serum in hand should, unfortunately, the disease spread further South, by immunising all cattle immediately adjacent to the outbreak, further spread of the disease will be prevented, or at least the devastating effects of previous epizootics minimised.

The serum manufactured at the Laboratory has not only been tested for use in British East Africa, but its potency upon other than East African cattle has been proved by submitting it to severe tests on cattle drawn from South Africa and England.

It has been made possible for the Laboratory to turn out large quantities of serum owing to the fact that from the Western Provinces of Uganda we can obtain numbers of highly susceptible cattle for serum production. Should, however, rinderpest, which still smoulders over considerable areas of the Eastern Provinces of the sister Protectorate, spread to the western side of the Nile, this supply might be cut off, and it would be necessary to obtain susceptible animals from Madagascar or South Africa.

The cattle purchased by our agent in the clean areas of Uganda are transported in barges across the Lake and entrained at Port Florence for the Laboratory Siding at Mile 333/11.

After the cattle have been used for serum production they are exposed on the East Coast Fever area at Kamiti for six weeks to two months, and are then sold by public auction as animals immune to rinderpest and East Coast Fever.

Plouro-Pneumonia.

It is somewhat remarkable that no outbreaks of pleuro-pneumonia have been recorded during the last twelve months.

This disease was at one time prevalent in several mobs of Masai cattle.

On their removal from Laikipia a specially selected area was set aside for their reception in the Southern Masai Reserve, and a Stock Inspector, whose sole duty was to supervise the animals and keep them in strict quarantine, was placed in charge of the area.

Quarter Evil.

This disease occasionally occurs in most districts of the Protectorate, and a protective vaccine against this disease is now manufactured at the Laboratory for issue to settlers. During the years smears from three bovines have been returned quarter evil by the Veterinary Pathologist, and an outbreak was reported at West Kenya which involved the deaths of several young animals.

Anthrax.

There have been three outbreaks of anthrax (involving ten oxen, one mule and four pigs) recorded during the year under review.

Among the native tribes the disease is fairly well known, more especially in Masailand and in Lumbwa, and frequent reports have been received of natives succumbing to the disease through eating the flesh of infected animals.

The disease has cropped up on farms far removed from each other, and in most of the outbreaks it has been impossible to get any reliable history.

An outbreak occurred among the Municipal oxen which resulted in four deaths.

In each outbreak the animals were treated with Pasteur's vaccine and their grazing grounds changed.

The symptoms in bovines in the above outbreaks closely resembled those of snake-bite, and it is possible that anthrax carcasses have been carelessly disposed of through the owner considering the cause of death to be due to bites of poisonous reptiles.

Anaplasmosis.

Among imported animals heavy losses have been sustained through this disease. Every endeavour is being made at the Laboratory to obtain pure strains of blood for artificial immunization.

Cattle have been specially imported from England, and pure strains of the causal organism have been sent from South Africa with which to inoculate these animals. Unfortunately, on each occasion the blood when received here was found to be inert.

Further experiments are on hand.

Dipping is an effective preventive of this disease.

Contagious Abortion.

The occurrence of the disease within the Protectorate has been demonstrated during the year. Efforts are being made to ascertain its distribution, and when satisfactory data on this point has been obtained measures for its suppression can be undertaken. The disease is widespread in Europe, and exists also in the Southern portion of this Continent, and assuredly accounts for considerable loss. In most herds the young female animal is most commonly affected, due to the fact that the primary abortion usually confers an immunity.

In very many instances, however, an apparently recovered animal may be capable of propagating infection. The diagnostic test is of a complicated nature, and can only be undertaken where laboratory facilities exist. It is probable that a vaccine can be utilised for the suppression of this disorder, and work in this direction is being carried out. It may be found necessary to schedule contagious abortion as a notifiable disease, and demand the testing of imported cattle.

Scour in Calves.

While this disease may be of a sporadic nature and may yield to medicinal treatment, the very large majority of cases are due to infection by a specific organism, the *Bacillus Coli*, through the recently ruptured, but still vascular, navel string. The disease is ubiquitous, and heavy losses among young animals have been sustained where cattle kraals have become grossly infected, and little or no care has been taken to tie up and disinfect the navel string at birth. If every stockmaster would see that his calving-down houses are thoroughly cleansed and disinfected, good clean fresh bedding supplied, the udder of the prospective mother cleansed and kept clean, and immediate attention given to all newly-born animals, he would find a marked decrease in the mortality among his young stock.

A number of farmers only dip their calves in order to prevent scour among them, and they are bitterly disappointed when they find that the animals they have so carefully dipped sicken and die of the disease. These farmers quite overlook the fact that

unless the mothers are dipped, an operation which disinfects the udder and teats, the calf becomes infected with the bacillus which is constantly present in the dung or on the soiled skin of the udder.

Some cattle kraals and calf houses become so grossly infected that the removal of the herd to new locations and only allowing stock to enter which have been thoroughly disinfected is the only possible means of suppressing this disease.

Endeavours are being made at the Laboratory to produce a serum which, it is hoped, will have the effect of supporting the young animal over the period at which it is most liable to infection, *i.e.*, from birth to about three months old.

Trypanosomiasis.

Several suspected cases in cattle brought through the Northern Frontier District have been submitted to microscopic examination, but so far no trypanosomes have been demonstrated.

It is, of course, known that many portions of that large district are areas infected with tsetse fly, but taking into account the very large number of cattle which have passed along the stock routes from the North the infectivity of the fly must either be extremely small or the trypanosome which they transmit must be comparatively innocuous to bovines.

Experimental medicinal treatment is now under test at Kibwezi with the strains occurring naturally in that neighbourhood. It is hoped that either a cure may result or the life of an infected animal prolonged.

In the fly infested districts of the Protectorate such treatment might prove very valuable as it would enable planters to use oxen for tilling and transport.

Three Days' Sickness—Ephemeral Fever.

Several cases of this disease have occurred during the past year in various parts of the Protectorate, more particularly in the Rift Valley and Kinangop Plateau.

Medicinal treatment has frequently been the cause of greater mortality than the disease itself, for farmers, unaware of the peculiar paralysis of the throat which often occurs in this disease, have choked their animals in endeavouring to drench them.

Tuberculosis.

The spread of tuberculosis in South Africa among imported and grade stock is causing considerable anxiety to the Veterinarians and stock owners there.

One case of tuberculosis occurred in East Africa during the past year in an imported English animal. This animal had been carefully tested in England and certified free from tuberculosis. Shortly after its arrival the animal exhibited peculiar brain symptoms and died after several months' illness. Post mortem examination revealed a tubercular lesion in the brain substance.

This is the only case of tuberculosis which has been reported in bovines in East Africa, and it behoves us to use every endeavour to prevent its introduction to our herds. It is now necessary for every imported animal to be re-tested on its arrival in this country.

Every animal which reacts to the tuberculin test will be slaughtered, but should no tubercular lesions be found on post mortem examination the owner will be entitled to receive full compensation for such animal.

The Veterinary Department asks for the very heartiest co-operation of the farming community in this matter. The ravages of tuberculosis at home and in the Colonies are too well known to be dilated upon here. So far as our knowledge extends, tuberculosis does not exist at the present time in British East Africa. It behoves us, therefore, to use every effort to keep this scourge from our herds.

Foot and Mouth Disease.

No cases occurred in this Protectorate, but in May an outbreak of this disease was reported in Uganda by Mr. Hutchins, Chief Veterinary Officer, and in consequence no cattle were allowed to enter into this Protectorate from the infected districts.

Professor von Ostertag, during his visit to the Laboratory, examined specimens and verified Mr. Hutchins' diagnosis.

The disease has since died out in Uganda.

Ophthalmia in Calves.

This disease is of frequent occurrence in indigenous and graded herds of the Protectorate, and is responsible for considerable economic loss.

In countries where dipping is in vogue much amelioration has been observed. It is possible that several causes may be responsible, but during the year, thanks to the assistance of a Lumbwa stock owner, one well-known factor in the shape of a small worm belonging to the genus *Thelazia* has been diagnosed. This parasite is known to be responsible for the ophthalmia in bovines in Europe and the East. The method of its transmission from animal to animal is not yet known, but probably a winged insect will eventually be inculcated.

HORSES.

Horse Sickness.

Although there have been cases of this disease in various portions of the Protectorate, more particularly on the Kinangop Plateau, no severe outbreak has been recorded during the past year.

With reference to the theory that mosquitoes are the transmitting agents of horse sickness, I would point out that owing to the high value of horses in this Protectorate it has been impossible for the Laboratory to undertake any experimental work in this connection.

I have suggested to Mr. Robertson, Assistant Director of the Veterinary Research Department of the Union of South Africa, and to Mr. Bevan, the Veterinary Pathologist of Southern Rhodesia, that experiments should be undertaken with a view to obtaining data in regard to the insects which obtain entrance to stables during the hours between sunset and sunrise.

The experiments would be conducted on the following lines:—

A number of stables of a temporary nature would be erected in a district in which horse sickness was prevalent. Each stable would be provided with mosquito netting, and the mesh of the netting would vary in size in the different stables. Susceptible animals would be placed therein and evidence as to the number and variety of insects which gain admittance would be ascertained by fixing insect traps and fly papers within the buildings.

In the stables in which an animal becomes infected with horse sickness careful examination of the traps and papers might supply valuable information as to the vector, for by a process of exclusion it might be proved that with the incident of the disease there might be found one variety of insect invariably present.

Should Messrs. Robertson and Bevan institute such experiments the results will be awaited with interest.

In the Protectorate there is a disease which occasionally occurs among horses, and which in its rapid onset, symptoms and course closely resembles horse sickness, but which has been demonstrated to be non-inoculable.

Every endeavour is being made to obtain material from such cases for further investigation.

Ulcerative and Epizootic Lymphangitis.

Epizootic and ulcerative lymphangitis have been very prevalent during the past year, and heavy losses have been suffered by the farmers on the Uasin Gishu Plateau from the ulcerative form.

The Preisz-Nocard bacillus, the causal organism of ulcerative lymphangitis, is ubiquitous throughout the Protectorate. It is found in dung and soil, and gains entrance to the animal's system through ulcers and wounds caused by ticks.

Quarantine measures, therefore, have little or no effect in controlling the spread of the disease, but the virulence of the causal organism is probably increased by passage through the animal's system.

As a preventive against this equine scourge dipping is indicated, and in the early stages of the disease very hopeful results have been obtained by immersing affected animals in arsenical baths at weekly intervals.

A vaccine has been prepared at the Laboratory, and its use has given very hopeful indications.

Its application is still rather too elaborate in practice, but it is hoped to modify the technique so that Veterinary Officers may test its efficiency under field conditions.

The epizootic form of lymphangitis is directly contagious, and is very probably carried by flies and tick birds (*Buphaga erythrorhyncha*), and to suppress it, in the absence of a practical method of treatment, destruction of the affected animals is indicated. With the permission of the owner this has, in many instances, been done. Compulsory slaughter of all infected animals is, however, desirable—a policy which can only be adopted by providing funds for compensation of owners.

Experiments with arsenic and mercury, singly and in combination, are being conducted at the Laboratory with a view to obtaining a curative treatment. The treatment is an elaborate one, and must be carried out over long periods. Several cures have been recorded, and it is anticipated that the technique will be perfected and adjusted to field requirements. Full details of these experiments will be found in the Veterinary Pathologist's report.

Prior to my visiting Abyssinia it was considered that the disease was brought into this Protectorate from that territory, but as I have previously reported, no case of this disease came under my notice during my journey through Ethiopia, and subsequent field data have proved that infection takes place within our own borders.

General.

Several cases of trypanosomiasis, mange and biliary fever have been recorded during the year. No case of glanders has occurred, and all imported animals have either been accompanied by satisfactory mallein test certificates or have been subjected to the test at our Quarantine Stations.

Horse breeding is now occupying the attention of a number of our farmers, and good sires and dams have been imported during the year. There is every reason to be satisfied with the foals bred in the country, and there can be no doubt that there is a great future for horse breeding in East Africa.

The prices of horses and mules have remained high both in private deals and public sales, and while it is satisfactory to the horse lover to see a good class of racing pony in the country, it behoves the farmers to devote considerable attention to the rearing of a utility animal.

What is required above all things is a cheap mare, such as is to be found in Abyssinia. With such a mare and a high class Arab stallion there would be produced a good class of animal, eminently suited to the requirements of the country, and an animal which would mate well with the thoroughbred sires from home.

There is a branch of horsebreeding which is, however, worthy of the attention of the East Africa stock farmer. That is the breeding of jennets. From Suk, Turkana and Samburu, good donkey mares can be obtained at a reasonable price (£3 to £5), and such animals, covered by a suitable pony stallion, would produce a hybrid useful for farm and transport work, and which to a very great extent would have considerable resistance to the prevailing equine diseases. It would prove cheaper than the Abyssinian mule, for which excessive prices are now paid, and, further, it would make us independent of importations from the North.

There is to be seen in Nairobi streets a hybrid by a zebra sire out of a donkey mare. This animal is bigger than a donkey, is "stocky" in build, and is a good type for transport purposes.

CAMELS.

With the opening up of Jubaland and the Northern Frontier District the camel for transport and riding purposes becomes more and more important every year, for on it depends the maintaining of our lines of communication with the outposts of our Protectorate throughout this vast and waterless country.

Mr. Leese, an expert in camel diseases, was specially appointed to undertake investigation as to the cause of the large mortality in the riding and baggage camels in Jubaland and the Northern Frontier District, and his report on the subject I append.

SHEEP.

Scabies.

Scabies is widespread among the indigenous sheep. It is hoped, however, with the adoption of a general dipping scheme, that we will be able to exercise more control over it and prevent its spread among the woolled flocks.

Strongylosis.

The mortality from strongylosis throughout the Protectorate is a very heavy one, and the flock-master must exercise constant supervision if he is to keep his animals free from the ravages of these parasites.

In sheep grossly infected a not uncommon symptom to be noticed by the farmer on his sheep returning from pasture, is an enormous œdematous swelling of the head and neck, which is often reported by the native herdsmen to be caused by snake bite. This swelling disappears during the night, and is an œdema due to the anæmic condition of the blood and the pendent position of the head while grazing.

One ounce doses of a 5 per cent. solution of Lysol has been proved to be of considerable value in the treatment of this disease, and its administration is attended with less risk than bluestone solutions.

Variola.

No severe outbreaks have been reported during the year.

GOATS.

Strongylosis.

Strongylosis has also been the cause of mortality among goats.

Pleuro-Pneumonia of Goats.

Several outbreaks of this disease have been recorded throughout the Protectorate, and the mortality in some instances has been very heavy. Its etiology and measures for its prevention and suppression are engaging attention at the Laboratory.

On account of this disease the export of goats to South Africa has been forbidden by Proclamation.

PIGS.

East African Swine Fever.

There have been, fortunately, no outbreaks of this disease during the past year.

Little success has attended the numerous experiments which have been made in an endeavour to obtain a protective serum against this disease. It has been proved, however, that the disease is neither air-borne nor transmitted by external parasites. Should the farmer, therefore, carefully fence in his piggeries and paddocks with wire netting, placing the netting underground for a distance of two or three feet to prevent burrowing, there should be little risk of the introduction of the disease, as it is by pigs grazing over areas soiled by infected excreta that the disease is propagated.

East African swine fever is distinct from the swine fever of Europe and America.

It is only but a few years since the domesticated pig was imported into East Africa, and the history of the disease and its incidence can only be accounted for by the disease being propagated and spread by the indigenous wild porcine species.

Every care should therefore be taken to prevent the warthog, bush pig and giant hog from gaining an entrance to pasture land.

In August and September last year a very heavy mortality was noted among warthogs on the Uasin Gishu Plateau. Carcasses and skeletons in large numbers were to be seen scattered over the plains and in the vicinity of pig holes. The mortality occurred when a severe epizootic of rinderpest was prevalent among the cattle on the plateau, which involved also numbers of eland and giraffe.

In Uganda and Ceylon during outbreaks of rinderpest it has also been noted that large numbers of wild pigs died, and in both instances the Veterinary authorities were convinced that rinderpest was the cause of death.

Anthrax.

Two cases of anthrax in pigs were recorded during the year.

DOGS.

The most prevalent diseases of the dog have been mange, piroplasmosis and distemper. One outbreak of rabies came under notice in the Nairobi District. Rabies in this country does not appear to be transmissible to man, for of the number of natives bitten by rapid jackals or dogs, and kept under medical supervision over considerable periods, not one has developed the disease.

OSTRICHES.

The chief drawbacks to ostrich farming in this country are the losses sustained through the ravages of wire worm and the depredations of lions and leopards.

It is well known that lions are fond of ostrich meat, and as many of the ostrich farms of the country are situated in close proximity to the game reserve these vermin are a source of considerable anxiety and loss to the ostrich farmer.

To protect his birds the farmer has either to hunt, shoot, trap or poison the vermin, or to kraal the birds at night in a corrugated iron boma, which results in soiled and damaged feathers; or to erect fences proof against lions and leopards, which is too expensive.

Professor Duerden has reported most favourably on the prospects of ostrich farming in this country, and no doubt in the future it will prove a remunerative industry, but it is one which should only be entered into by those possessing considerable experience.

We can only hope to produce a better class of feather by breeding from selected birds. The method of hatching out eggs collected on the veldt, which was necessary at first to found the industry, is very unsatisfactory, for nothing is known of the parents, and in consequence much time, labour and money is wasted in rearing birds and keeping them to an age when it can be decided whether they are of value or not.

To obtain a high-class bird it is essential that careful selection be made, and that the breeding birds be placed under as natural conditions as possible, *i.e.*, in fairly extensive paddocks, where they can remain undisturbed and unmolested. Under present conditions this would be expensive, but it is considered that the improvement in the quality of the progeny would ultimately amply repay the farmer.

For some years past emasculation of the male bird and the removal of the ovary in the female has been attended with considerable success in South Africa, the birds operated upon producing a better class of feather, and the damage to birds from fighting minimised. It is our intention to undertake similar operations here.

Experiments recently conducted in South Africa with carbon bisulphide tend to show that this drug is an effectual remedy for wireworm (*Strongylus Douglassi*) in ostriches.

POULTRY.

With the exception of Kikuyu Fowl Disease—a disease analagous to Fowl Cholera, poultry of all classes do extremely well. Kikuyu Fowl Disease is extremely fatal, and its course is rapid. A number of experiments are on hand with a view to obtaining a preventive vaccine. The poultry farmer should be warned against the danger of mixing new importations of native fowls with the home stock. All new additions to the farm should be kept strictly separate for a period of six weeks. The disease is fairly prevalent among the indigenous fowls, more particularly in the Nairobi and Kiambu districts, and the greatest care should be exercised when purchasing new stock.

Large numbers of good class birds have been imported during the year, and there is a ready and good market for eggs and poultry for the table.

Like all other farm stock, fowls are liable to considerable external parasitic infestation, and the weekly immersion of fowls in cattle dipping fluid of three days' standard strength has proved most beneficial.

GENERAL.

Permit System.

A Permit Officer is now in charge of this system. His duties are to issue permits for local movement of stock in and around Nairobi, to check and file duplicates of all permits issued throughout the Protectorate, to keep Permit Issuers posted as to outbreaks of contagious diseases, and to supervise the entering and releasing of animals passed through the Kamiti East Coast Fever testing area.

The permit system is now thoroughly understood by officials, farmers and natives, and there are possibly few places in the world where primitive man has been so apt in understanding the why and wherefore of quarantine.

The following permits have been issued from the Permit Office during the year:—

Immune cattle ...	...	...	735 permits
Non-immune cattle ...	...	...	1,320 „
Sheep and goats ...	...	...	1,788 „
Pigs ...	...	...	11 „

I would take this opportunity of thanking the Honorary Permit Issuers for their co-operation and kind assistance during the past year.

The issuing of permits is oftentimes a thankless task, but it should be remembered that it has done much to prevent the spread of disease, and has been the means of assisting the police in their endeavours to check stock thefts.

Live Stock Importations.

The following animals were imported through the Ports of Mombasa and Kilindini during the past twelve months:—

Horses	...	...	...	150
Mules	...	...	...	24
Donkeys	...	...	...	207
Cattle	...	...	...	634
Camels	...	...	...	23
Sheep	...	...	...	5
Goats	...	...	...	22
Pigs	...	...	...	9
Poultry	...	...	...	540
Dogs	...	...	...	161

Of these, nine horses were imported from England, fifty-nine from South Africa, one from Australia, and twelve from India.

Seventy-five pure bred cattle were imported.

Importers should be warned that they run considerable risk in importing animals from England with thick winter coats. Such animals arriving in the land-locked harbour of Kilindini suffer extremely from the heat. They are then transported rapidly to our Highlands, where, in consequence of the great difference of temperature, there is grave danger of pneumonia ensuing. In one instance three out of five cattle recently imported with heavy coats died of pneumonia. In winter or early spring it is advisable to clip animals prior to shipment, and to provide them with thick blankets for the voyage from England to Suez, or, should the owner travel with the animals, to clip them on the voyage when the temperature demands it.

Improved horse boxes and cattle trucks are now being constructed by the Uganda Railway. These will not only have an air space in the roof, but will have adjustable louvres at both ends of the vehicle, and will carry a forty gallon water tank.

We must anticipate larger importations of pure-bred stock in the near future, for, with the adoption of a dipping scheme, confidence will be restored, and an enormous impetus to the stock industry of this country is likely to take place.

Meat Inspection.

The following are the Nairobi slaughter-house returns for the past year:—

		Slaughtered		Condemned
Bullocks	...	1,567	...	88
Sheep and Goats	...	35,957	...	211
Pigs	...	102	...	2

Seventy-one bullocks were condemned for measles and sixteen for East Coast Fever.

Pleuro-pneumonia and Nairobi Sheep Disease were the principal diseases recorded in sheep and goats. Of the sheep and goats condemned 50 per cent. were judged unmarketable on account of their emaciated condition.

The following figures demonstrate the increase in the number of animals slaughtered annually at the Nairobi Abattoir, and the time is not far distant when it will be necessary for the Municipality to employ a Veterinarian permanently for the important duties connected with meat inspection.

	1911-12.	1912-13.	1913-14.
Bullocks	... 765 ...	1,057 ...	1,567
Sheep and Goats	... 26,756 ...	30,482 ...	35,957

During the twelve months under consideration a dearth of mutton sheep has more than once occurred.

This scarcity is due probably to administrative restrictions, which forbade the taking of cattle for bartering purposes into the Masai Reserve, and also to the large numbers of sheep purchased by the Akikuyu.

The Municipality have already sanctioned funds for the improvement and extension of the Nairobi Abattoir. During the hot months of the year it is extremely difficult to keep meat for any length of time, the result being that much of the meat consumed is tough and indigestible. While the extensions to the Abattoir may allow of meat being hung for longer periods there can be no doubt that to obtain good marketable meat a system of cold storage must very soon be adopted.

Already several influential firms interested in cold storage have turned their attention to East Africa as a country possessing considerable potentialities for the production of beef and mutton.

The world's beef supply is a matter of the greatest interest to all countries where cattle can be ranched under favourable conditions. The grazing over our extensive pasture lands is eminently suited for the rearing of cattle, and the labour required is cheap and readily obtainable, for the majority of the native tribes are pastoral, and willingly agree to work on stock farms.

South Africa and Rhodesia have already turned their attention to the production of beef, for the world's beef supply is not increasing in proportion to the population. This is largely due to the curtailment of grazing lands in the United States and Canada, where large areas of land formerly used for ranching purposes are now being split up into smaller holdings for mixed farming.

It is true that there is much to be done to improve the type and quality of our cattle. The indigenous cow, however, forms a good foundation from which to grade beef-producing animals, and under dipping conditions, which will allow of the importation of Boran heifers into the grazing areas of East Africa, the cattle industry should rapidly advance, for the Boran animal is comparatively cheap, and mates well with our imported bulls.

Mozambique has already four cold storage establishments in working order, and the cattle which they are slaughtering are very similar to our indigenous stock. There could be no greater incentive to cattle raising than the establishment of a cold storage plant, and it is to be sincerely hoped that the large firms who are now looking for fresh fields of enterprise will receive every encouragement to commence operations in this essentially stock raising country.

Milk Supply.

The demand for milk in the capital is now a very large one, and dairy farms have sprung up, not only in and around Nairobi, but in the Lumbwa and Molo districts, which export large quantities of dairy produce. The Lumbwa Creamery has proved a great success, and within the next year or two similar institutions will no doubt be established in other portions of the Protectorate. In the vicinity of Nairobi both the Masai and Akikuyu have taken to dairying, and much of the milk which they themselves formerly consumed is now brought, morning and evening, into the township. In their methods of delivery there is much left to be desired, and regulations will soon require to be framed which will provide inspection, demand cleanliness and regulate the supply generally.

In Mombasa the dairymen, mostly Indians, have been already removed from their insanitary surroundings and their cattle housed on the shambas away from human habitations.

When a water supply for the Municipal byres is assured all animals used for dairy purposes will be housed in the byres, and will be regularly inspected by a Veterinary Officer.

Trading.

Sale yards have been established by the Municipality in Nairobi and by Messrs. Newland, Tarlton and Co. at Naivasha, Nakuru and Londiani.

The largest sales have been conducted at Naivasha, where approximately 8,500 head of cattle passed through the yards. Ninety per cent of these came from Borana and Jubaland. In addition to public sales some 5,500 head of this class of stock changed hands privately.

Through the veterinary stations situated at Rumuruti and Laikipia the following stock was inspected, inoculated or dipped, and passed:—

Cattle from Jubaland and Borana ...	14,203
Sheep and goats from Baringo, Suk Turkana ...	44,850
Horses and mules from Borana ...	333

No fewer than 82,105 sheep and goats passed down the Rift Valley from the Native Reserves of Suk, Turkana, Kamasia and the Uasin Gishu Masai. Large numbers of sheep and goats are now required at the various centres for butchering purposes, and Masai ewes are in great demand by the sheep breeder.

The majority of the wethers are brought by Somali traders from Suk, Turkana and Samburu.

In the Nyeri market alone over 50,000 sheep and goats were disposed of to the Akikuyu at an average price of Rs. 9 per head. The Akikuyu are rapidly acquiring stock, and the expenditure of some 450,000 rupees in one market shows that they are well off, and must have done considerable labour outside their reserve to acquire such an amount of "hard cash."

It is hoped that a very large development in the pig industry will shortly take place as the demand for pigs by the Bacon Factory is a large one.

Visitors.

During the year Dr. Wolfel, of the Veterinary Department of German East Africa, visited the Protectorate to enquire into rinderpest and our method of serum production. Professor von Ostertag, P.C., the eminent German veterinarian, together with Dr. Lichtenheld, the chief of the Veterinary Department, German East Africa, and Mr. Sommerfeld, of his Department, visited East Africa to enquire into our organisation. We have had the pleasure of visits from Mr. Lane, Chief Veterinary Officer, and Mr. Hart, of the Veterinary Department, Northern Rhodesia, and Mr. Payne, F.R.C.V.S., of the Veterinary Department, Cape Colony.

His Excellency, Mr. Smith, accompanied by Mrs. and Miss Smith, visited the Laboratory in September on his way to take up his duties as His Majesty's Governor of Nyasaland.

In conclusion I should like to place on record my appreciation of the excellent services to the Protectorate rendered by Mr. Brandt, who has been appointed to the responsible position of Chief Veterinary Officer, Nigeria.

I would take this opportunity of thanking the Administrative Officers, the members of the Police Department, my District Officers, the Veterinary Pathologist and his staff, the Permit Officer, Stock Inspectors and the clerical staff for their help and co-operation during the financial year of 1913-1914.

I would thank Mr. J. K. Watson for allowing dipping demonstrations to take place on his farm, Doonholme, near Nairobi.

To the stock owners of the country my thanks are due for their assistance and kind appreciation of the services of my staff during a year of anxiety and difficulty.

I append the report of the Veterinary Pathologist and one by Mr. Leese; also a report on the rinderpest double inoculations carried out at Lumbwa, and the Veterinary Dispensary returns.

ROBERT J. STORDY,

Chief Veterinary Officer.

RETURN OF OUTBREAKS OF CONTAGIOUS AND INFECTIOUS DISEASES.
 NAIROBI DISTRICT, FOR THE YEAR 1913-1914.

Diseases.			Animals.	No. of Outbreaks.	No. of cases.
East Coast Fever	...	...	...	...	68
Rinderpest	...	...	...	...	...
Anthrax	...	...	{ Oxen	3	10
			{ Mules	1	1
			{ Pigs	1	4
Epizootic Lymphangitis	...	...	Horses	...	6
			Mules	...	12
Ulcerative Lymphangitis	...	...	{ Donkeys	...	1
			{ Horses	...	21
			{ Mules	...	16
Horse Sickness	...	...	Horses	...	11
			Mules	...	7
Fly	...	...	{ Horses	...	3
			{ Mules	...	5
			{ Donkeys	...	17
			{ Dogs	...	2
Biliary Fever	...	...	Horses	...	2
			Mule	...	1
Tick Fever	...	...	Dog	...	40
Distemper	...	...	Dog	...	12
Nairobi Sheep Disease	...	...	Sheep	4	90
Kikuyu Fowl Disease	...	...	Fowls	3	...
Anaplasmosis	...	...	Ox	...	5
Sheep scab	...	...	Sheep	2	...
Rabies	...	...	Dog	1	1
Abortion (Contagious)	...	...	Bitch	1	several.

RETURN OF DISEASES ATTENDED AT THE VETERINARY DISPENSARY,
 NAIROBI, DURING THE YEAR APRIL 1st, 1913 TO MARCH 31st, 1914.

Diseases of the Digestive Organs	...	...	...	142
" " " Respiratory Organs	...	...	...	21
" " " Generative Organs	...	...	...	11
" " " Skin	...	...	...	40
" " " Ear	...	...	...	11
" " " Eyes	...	...	...	43
" " " Teeth	...	...	...	18
" " " Liver	...	...	...	6
" " " Urinary organs	...	...	...	2
Worms . .	...	...	...	68
Wounds, Cuts, Ulcers	...	...	...	250
Abscesses	...	...	...	58
Tumours	...	...	...	29
Fractures	...	...	...	19
Examinations for soundness	...	...	...	240
Lamenesses	...	...	...	63
Dislocations	...	...	...	3
Paralysis	...	...	...	2
Fever	...	...	...	5
Rheumatism	...	...	...	1
Anaemia	...	...	...	5
Operations on tails	...	...	...	26
Animals destroyed.				
Dogs	...	...	...	10
Cat	...	...	...	1
Ox	...	...	...	1
Mule	...	...	...	1
Castrations				
Horses	...	...	...	3
Bulls	...	...	...	54
Cats	...	...	...	5
Donkey	...	...	...	1
Pigs	...	...	...	5
Neurectomy	...	...	...	1
Trephining	...	...	...	1

FINAL REPORT FOR 12 MONTHS ENDING 31ST MARCH, 1914.

By A. S. LEESE, VETERINARY OFFICER ON TOUR IN JUBALAND.

The preliminary report which I sent on 16th December, 1913, on military camels in Jubaland deals with many matters on which I was engaged up to that time. I now send a report on camel diseases met with, and a few other notes. Under the circumstances I found experimental work almost impossible.

Just before I left Serenli the transport sustained a severe setback because of heavy mortality in camels which went down to Kismayu and back in November and December via "Soames' Road," instead of via Afmadu as was the intention when they started. This safari resulted in at least 80 per cent. getting trypanosomiasis.

Many rubbishy animals were still being acquired as remounts because under some of the contracts any camels the purchasing agents buy in the interior have to be taken whether approved of or not. I consider that the Veterinary Officer and Transport Officer should decide in the case of camels received as "fines" whether or no to accept animals tendered. A recent "fine" contained many cases of trypanosomiasis, immature and unfit camels, which would not have been passed by these officers if they had had the chance to stop them.

When Arab saddles are used they require constant inspection by the N.C.O.'s to prevent the wood from galling the withers; and the two pads under the wooden arches must *not* be sewn together over the spine, but must be supported by lashing them to the arch itself, leaving the top of the withers naked.

The Indian palan is by far the best pack-saddle. As there seems likely to be a very considerable permanent camel transport here I strongly recommend its introduction, with a few genuine palan makers. The Herio is not fit for military transport, and every time a safari comes in without a European officer to examine all backs every evening, a considerable proportion of camels have to be laid up for weeks and months by sore-back. The Arab saddle is as bad as the Herio for causing sore-backs except when a European officer is there to inspect backs and saddles every evening and to point out defects in the latter for alteration. Native syces rarely seem able to appreciate the fact that a "rub" detected on the day it occurs is quickly healed, whereas a sore which has had a Herio applied to it day after day may take months to heal.

The general management of camels and reporting of sickness is now greatly improved. My best thanks are due to the officers in charge of camels at Serenli for their assistance in connection with my duties. I left Serenli on 18th January, 1914, the day before the convoy was to start thence to Garbahari. I travelled south by "Soames' Road" to Mfudu and examined it with reference to the prevalence of biting flies in the dry season, and the possibility of working camels on it in teams as in Australia. Want of transport unfortunately made it impossible to travel on the inner road between Mfudu and Yonte, and I had to get down from Mfudu as best I could in dug-outs. Until I have seen this part of the road I am unable to come to any decision either as to the best form of animal transport or as to the avoidance of "fly" on it at different seasons.

For similar reasons I could not get to Armadu. On 4th March, when in Kismayu, I received a sudden order to go immediately on military service with the Marehan expedition. I pointed out at once that military service is not provided for in my agreement, but expressed my willingness to undertake such duty on temporarily altered scales of pay and leave, with equitable provision for sick leave or disablement. I hope an arrangement may be come to, particularly as I have worked for years with the 53rd Camel Corps, part of which has arrived here from India.

CAMEL DISEASES IN JUBALAND.

In this report the diseases of most economic importance only are described. Certain words used locally to indicate camel diseases, etc., may be translated as follows:—

Gandhi—Acute trypanosomiasis.

Gandhi—Tsetse fly.

Dukan—Sub-acute and chronic trypanosomiasis.

Bal—*Tabanus* ("Horse fly," "Hippo fly").

Sheda—*Hippobosca* ("Camel fly").

Dugato—Pneumonia.

Kud—Any disease occurring suddenly with rapidly fatal results. Such cases as I saw were due to trypanosomiasis, and *not* Anthrax.

Shimbr—Any disease occurring suddenly and accompanied by symptoms of brain derangement or of paralysis. Sometimes due to trypanosomiasis, sometimes to other causes.

Addo—Mange.

Trypanosomiasis.

In its most typical form it is a remittent or intermittent fever, the paroxysms of which are alternated by intervals during which the temperature returns to normal or near normal. During the attacks of fever trypanosomes are found in the circulating blood, whilst during the intervals between the attacks examination of the blood generally reveals no trypanosomes. As a result of the successive attacks of fever the animal ordinarily becomes anaemic, weak and emaciated.

In Jubaland camels this is by far the most common and important disease. I have, with two doubtful exceptions, only noted one form of it, *viz.*, that due to a long flagellated trypanosome resembling both *T. brucei* and *T. evansi*. It appears to be spread through the agency of both tsetse and tabanus (possibly sometimes by other biting flies). The native idea is that acute trypanosomiasis is caused by tsetse (Gandhi) and chronic trypanosomiasis by Tabanus (Bal). But in India we get both acute and chronic cases where no tsetse exists, so that it is probable that both genera of fly can cause acute and chronic cases, although it is quite likely that the tsetse may, on the average, transmit a more virulent strain than Tabanus.

MORPHOLOGY OF TRYPANOSOME.—A long slender trypanosome with no "stumpy" forms. Posterior end sometimes blunt and conical, sometimes sharp and pointed. Protoplasm of body extends often nearly to the end of the flagellum. Undulating membrane well developed. Blepharoplast some distance from posterior extremity. When stained faintly blue, an oval vacuole is often seen in front of blepharoplast, but deeply stained slides show no vacuole. Granules are marked only when the staining is such as to make the red corpuscles purple in colour.

A second form was sometimes seen in a minority with shorter, narrower body, undulating membrane less developed, blepharoplast near posterior extremity, granules few or none, free part of flagellum short. Rather like *T. Cazalboni*, but was probably only an undeveloped trypanosome of the same species as the long one, because both forms can sometimes be recognised in a trypanosome in which fission is nearly complete.

It appears as though the trypanosome in question is sometimes *T. brucei* and sometimes *T. evansi*, and as this is one of the few countries where camel country and tsetse are found overlapping one another, Tabanus being found also, it is not impossible that a true Ngana trypanosome (*T. brucei*) transmitted by tsetse may not be altered on the spot into the form known as *T. evansi* by passage owing to mechanical transmission from camel to camel by Tabanus.

SYMPTOMS.—The symptoms of Jubaland Camel Trypanosomiasis are identically those of Indian Surra. The disease may run an acute, sub-acute or chronic course.

(1) ACUTE FORM.—There is fever nearly every day and death within a few weeks. The trypanosomes can be found in the blood nearly every day, and the camel pines rapidly. He grazes poorly, fitfully, or not at all, but may eat rations well. His flanks fall in because he comes away from the grazing ground without having filled himself. The neck and head droop a little, the nose below the level of the poll. He stands about listlessly and a little watery discharge runs from the eyes. He generally chews the cud and drinks, but not as much as in health. The temperature is generally between 98.5 and 103 F. in the morning, and 102 to 106 F. in the evening. Cows in calf abort as a rule, or, if they were in milk, go dry. There is frequently nothing very definite beyond the symptoms of fever. Edemas (dropsical painless effusions under the skin) are often met with about the base of the pedastal, the lower part of the abdomen and chest, the sheath, hind legs, and in the depression behind each eye.

The end is often hastened by complications such as bronchopneumonia or œdema of lungs; or death may occur suddenly in the night or on the march, and if preceded by brain symptoms, amaurosis, paralysis, hæmaturia or opthalmia, as it may be, the true nature of the disease often passes unrecognised by the camelman.

(2) SUB-ACUTE FORM.—The duration is from two to four months. The symptoms are less marked than in the acute form, but otherwise similar. The febrile paroxysms occur at intervals, during which there may be neither symptoms of sickness nor trypanosomes in the blood.

(3) CHRONIC FORM.—With this form, the camel may suffer from four months to, say, three or four years before it succumbs. The majority die in the first or second year of the disease, but a few recover after three years or so. The termination of chronic trypanosomiasis is largely influenced by the treatment the camel has received. Thus, hard worked transport camels generally die, whilst many meat camels recover.

The fever paroxysms at first last from two to seven days, and are followed by intervals lasting from three to ten days. After the first year of disease there is a tendency for the fever paroxysms to be reduced in duration, and for the intervals to be lengthened so that the trypanosomes appear in the blood less frequently than they did at first. This is the first sign of the protracted process of recovery, and if the camel is at rest he will generally begin to regain some of his lost strength and condition. Native camelmen think that when this happens the camel has recovered, but as with Indian "Surra," the camel continues to suffer from occasional slight febrile attacks of which the symptoms remain unnoticed, and acts as a dangerous reservoir of infection to other camels, probably for a further period of one and a half to two years, and sudden death may occur at any time.

During the fever paroxysms of chronic trypanosomiasis the symptoms are often so slight as to pass unobserved. The grazing guard may notice that the camel does not graze as usual, but he

nearly always eats his rations when he returns to the lines. Other symptoms, if present, are similar to those of the acute form, but are much less marked, *viz.*, hollow flanks, watery discharge from eyes, raised temperature.

In the intervals the camel may show no obvious signs of ill-health, but after a time loss of condition becomes apparent, the hump being reduced in size, and the neck and quarters taking on a scraggy look; the hair is easily pulled out of the tail, and the camel may show a difficulty in rising under a load.

Death may occur at any period in the course of the disease from exhaustion, and camels with chronic trypanosomiasis are very liable to pneumonia, which often finishes them off. Sometimes, as in acute trypanosomiasis, death is preceded by brain-symptoms or by paralysis, and not infrequently the camel may never have been noticed sick at all, and suddenly falls down dead, the camelman never suspecting "fly" at all, and giving the cause of death same fancy name such as "Kud" or "Shimbr."

DIAGNOSIS.—The only certain method of diagnosis is by microscopic examination of the blood. The disease is so common and its symptoms so indefinite that the examination of all camels "off feed," in fever, or unthrifty, is often incomplete without such blood examination. If trypanosomes are not found when the camel is in fever one may generally conclude that the camel is not suffering from trypanosomiasis, but not always, *e.g.*, when the camel has pneumonia as well. If trypanosomes are not found, and the camel's temperature is not abnormal, the blood of the suspected camel should be examined every second or third day until either one is satisfied that it has not got the disease or one finds trypanosomes. It is often difficult definitely to diagnose recovering cases of trypanosomiasis.

The principal symptoms which lead one to suspect trypanosomiasis are:—

1. Irregular appetite on the grazing ground, *i.e.*, some days he grazes well, some days not.
 2. Falling off in condition.
 3. Œdemas.
 4. Hollow flanks.
 5. Abortion in cow camels.
 6. A peculiar smell from the tail, arising from the urine.
- This is not constantly present, however.

The blood for examination is most easily taken from the tip of the ear. Care must be taken to disinfect the scissors before using them on a second camel as it is possible to inoculate the disease by its means. Veterinary surgeons should note that the temperature of camels even during a paroxysm with trypanosomes fairly numerous in the blood, occasionally registers only 97 F. in the morning, a figure which often represents a normal temperature in healthy camels at that time of day.

METHOD OF PROPAGATION.—Although no experiments have yet been possible in Jubaland, there is no doubt whatever that the disease is spread by biting flies.

The tsetse fly *Glossina pallidipes* is probably a true host in which the trypanosome undergoes part of its life history. The bite of any species of tsetse on the Juba River is, in the present state of our knowledge, to be feared.

Tabanus is also involved, but evidence points to its role being mechanical or direct, *i.e.*, possibly only dangerous in the presence of a camel or other animal with trypanosomiasis. It is his habit to pass from one animal to another to get a full meal of blood, and so to inoculate a healthy camel from a diseased one, a process which experiment with Tabanus in North Africa, India and the Malay States has shown to be easy.

Transport Officers should learn to recognise Tabanus, of which there are many species of different sizes and colours. The larger the species the more active are the flies; and therefore more dangerous.

It is probable that other biting flies, such as *Hæmatopota* and *Lyperosia* occasionally help to spread the disease also.

TREATMENT.—Segregate the sick.

Examine daily or frequently all camels which were in contact until all the cases have been discovered.

A definite curative treatment is known, but requires an expert to carry out. It takes three weeks, and costs about Rs. 4/50 in drugs per camel, and the camel will be thrown off all work for about two months.

Failing this, there are two alternatives, *viz* :—

1. Give complete rest and the best grazing possible, with the object of giving the camel the best chance of natural recovery. As this takes years it is seldom practicable except with young camels and cows; or

2. Work the camels in segregation, giving them the odd jobs or making up safaris of them, especially those having to go through fly country, until they gradually die out.

PREVENTIVE MEASURES.—In a country like Jubaland the following measures are necessary against trypanosomiasis in camels :—

1. Avoid taking camels to places infested by either tsetse or Tabanus.

2. Early diagnosis of cases of trypanosomiasis.

3. Segregation of cases.

4. Careful examination of remounts, whether purchased or received in payment of fines, to prevent bringing cases in.

In the dry seasons the tsetse *Glossina pallidipes* is confined to the vicinity of dense bush near water in rainy season, and for some time after, it may be found as far as half a mile away from water, and in greater numbers. In the hot season it is most active in the daylight before 9 a.m. and after 4 p.m., and occasionally bites after dark. Probably in the cooler season it is fairly active also at mid-day.

Tabanus is found near water, but has a wider distribution than tsetse, requiring little or no shade. It is most abundant during and after the rainy seasons, and the numbers fall off greatly as the dry season advances. In fact, at the end of it they may be hard to find. It is found biting camels as far as half a mile from water. In the hot season it is most active in the daylight before 9 a.m. and after 4 p.m. In the cool season it is more active at mid-day.

Hæmatopota has very similar habits.

Lyperosia is found in the desert as well as near the river, and cannot be avoided. The numbers are much greater after rain than in the dry season. Early diagnosis and segregation of trypanosomiasis cases are necessary even in the desert, because Indian experience shows that these small biting flies are sometimes capable of spreading Surra in camels.

Camels should not be taken on safaris along the river where tsetse is found, or when *Tabanus* is other than scanty; nor should they camp within three-quarters of a mile of the nearest permanent water in fly infested country. The water should be carried to the camels below Selagli, *i.e.*, they should not be taken down to water; although at Selagli itself they may be watered at the river at mid-day, though only at seasons when tsetse are scanty. On the track between Dakach and Serenli I found no tsetse, and comparatively few *Tabanus*, and I consider it safe for camels except during the rains, and at least a month afterwards. On the road from Serenli to Garba hari *Tabanus* is only found during and after the rains, and then only near permanent water (Fanwen River and Dar). At those seasons camp should be at least a quarter of a mile from the water at these halts. At Garba hari, *Tabanus* is so scanty as to be negligible. On the track between the Garwen River and Lolashid, *Tabanus* is said to be met with in the rainy season between El Merera and Lolashid, but between 10th and 12th November, after the short rains, I never found any except at Lolashid, and I do not think there is much danger except for camels living at Lolashid itself, and for camels taken down to water at El Merera. At Kerao there are a few *Tabanus* after rain, but provided the camp is sufficiently far from the water the danger is, I think, negligible. Tsetse is reported to exist on the Dawa River, and *Tabanus* is reported abundant after rain below Dolo. At Serenli itself, *Tabanus* is surprisingly scanty, even after the rains, and is only occasionally seen on the parade ground. On the whole, on the river between Dakach and Lolashid, *Hæmatopota* is rather more common than *Tabanus*. A good rule for safaris along tracks passing within three-quarters of a mile of the river is to graze the camels always to the west of the road; or if on Soames' road below Selagli, to graze the camels to the opposite side of the track from where the water is.

Early diagnosis of trypanosomiasis, with immediate segregation of camels affected, is dependent on (1) prompt reporting of camels not grazing well, etc., and (2) routine examination of all the camels for trypanosomiasis by the veterinary attendant. The

latter should take the temperatures of a number of camels every day so that in the course of a month he would have seen, say, 300 or more of supposed healthy camels. Any camels with raised temperature, unthrifty, with œdemas, or with irregular appetite, would then have the blood examined. By taking temperatures he will diagnose many cases which have not been noticed sick by the camelmen, and would otherwise have remained as reservoirs of infection with the healthy animals. It is best to use four or five thermometers, to save time.

Examination of remounts, whether purchased or taken in fines, should include examination for trypanosomiasis. Trypanosomes may, of course, be absent on the day the blood is examined, but even when only one day's examination is possible it will save the purchase of many diseased camels, though not all. In the case of fines I see no reason why the animals should not pass seven days on approval, the temperature being taken daily. Among some camels acquired by the Transport early in January, 1914, without a preliminary veterinary examination, at least 20 per cent. were affected with trypanosomes. The tribes unload their diseased camels on to Government in fines, and to prevent this the decision as to whether a camel should be accepted or not should rest entirely with the Veterinary Officer, or in his absence the Transport Officer.

Mange.

There is no need to go into the symptoms, etc., of this disease. It is rather easily cured in Jubaland in resting camels, because there is no cold weather, and therefore no long coats. But it may be mentioned here that the dressing (sulphur 1 part, sim-him 5 parts) should be preceded by washing (either in the sea or in water containing washing soda) and that it is useless merely to dress a camel once and then wait until he begins to itch again before dressing him again. In any advanced case the dressing should be applied all over the body on at least two, and often three, occasions, at intervals of six or seven days. Camelmen are apt to dress the parts well that are easy to get at, and to "skip" the difficult parts; so that special care is necessary to see that the jowl, armpits, groin, the bends of the joints of the limbs, and the hind feet, are properly dressed.

Camelmen should instantly report the first signs of mange, and, if this is done in this country it may often be cured by applications merely to the diseased part. Otherwise the whole body must be dressed. Interchange of herios and of Arab saddles or parts of them should not be allowed; every camel should have his own saddle. Saddles and halters require disinfection on the same day that the camel is dressed.

Mange is most active in and after the rains, and during that time camp should be changed constantly.

"Gub" (CONTAGIOUS NECROSIS OF THE SKIN).

This disease is known also in India, where it is called Joolak or Jooling.

CAUSE.—In smears of the pus obtained from cases at Serenli, an organism resembling morphologically the Preisz-Nocard Bacillus was found, and material was forwarded to the Veterinary Bacteriologist. It is not yet known whether this or the streptococci and staphylococci, also present, or any of them, are the causal bacteria; but experiment and experience both show that the disease is spread by the discharge from a lesion being rubbed into the skin.

SYMPTOMS.—The lesions occur almost anywhere on face, neck, withers, sides, quarters and rump, but rarely on the under surface of the body nor on the legs below knee and hock.

Actually the first symptom is a painful swelling, but ordinarily when first noticed the lesion resembles a "sitfast," its centre being a hard, dry, dark piece of dead skin, usually circular or oval, from which the hair has fallen out. Around this is a painful and sometimes swollen area or inflamed skin, the dead and living tissue frequently showing a definite line of demarcation. On pressure at the side of the lesion pus generally appears at some part of this line. The necrosis does not involve structures below the skin, but the dead skin is under-run with pus, excepting sometimes at the centre, where it may adhere to the tissues below.

The diameter of the lesion is anything from $\frac{1}{2}$ in. to 4 ins. The lesion is irritating, and in spite of the pain the camel rubs at and bites the part if he can. Adjacent lymph glands are generally swollen, hot and painful.

In most cases the central dead portion eventually sloughs out *en masse*, but, often, the edge of the resulting sore does not heal, but becomes, in its turn, hard, dry, dark and stiff, the process of necrosis (local death) tending to spread outwards; the necrosed edge will be found under-run with pus. The sloughing sore, with its pus and semi-detached pieces of necrosed skin, has a most repulsive appearance.

Fresh lesions may appear on other parts of the skin, but as they are generally caused by auto-inoculation, the parts most likely to come into contact with pus from the first lesion are those usually affected. Thus a lesion over the side of the chest is liable to be followed by others below it, or on the same side of the face; lesions on the rump are liable to cause others on the back of the second thigh; lesions on the withers to cause others on the poll, and so on.

Bald unpigmented scars on the skin are left when the lesion is healed.

As a rule proper treatment will result in recovery unless the lesions are already extensive and numerous, in which case the camel is generally weak, and may die of septicæmia.

The quickest recoveries are those in good general condition or in which the dead skin tends to separate quickly. The slowest are those in poor condition, or in which the process of necrosis tends to spread outward. A camel may be laid up with this disease for weeks, because it is very contagious, and must be kept isolated; and not infrequently "gub" affects the withers as a complication of "sore back."

Experiment in India shows the "period of incubation" to be ten or twelve days.

TREATMENT.—Isolate the patient as much as possible; segregation of the affected camels is not enough, because the animals often inoculate one another in fresh places, and so delay recovery. For instance, a camel with a lesion on the under side of his neck easily transmits it to the quarters of another on which he rubs.

Tethering posts, ropes, surgical instruments, and the ground on which discharges drop, may all act as media in carrying the contagion. They must be kept disinfected—the ground by burning wood over it. The camping ground should be shifted once a week. Those engaged in dressing or operating on the lesions must wash and disinfect their hands before touching healthy camels. Diseased tissue removed should be burned.

As to the lesions, their proper treatment requires skill. The object should be to get rid of the dead part as quickly as possible, leaving a clean, healthy edge to the sore, and to prevent the discharge from the lesion from causing fresh lesions in other parts of the skin.

Quite new lesions with a swelling of which the centre is not yet necrosed may be arrested completely or converted into simple abscesses, by two or three daily applications (with friction) of pure carbolic acid.

When the centre is necrosed already, the line of demarcation between the dead and living tissue is generally easily puncturable by one branch of a pair of dressing forceps, which is then passed under the stiff dead piece of skin, and a grip taken. The centre can then generally be torn away without using much force. If not, apply, with a little friction, pure carbolic acid around the circumference of the lesion, and wait one day and try again. In those cases where the dead tissue cannot at once be removed by traction, it is necessary to drain the pus from under the dead piece and syringe some disinfectant under it, and leave a plug of tow there saturated in Carbolised oil. It is best not to use the knife in separating the dead core, because it is difficult to excise it without re-inoculating the live tissue around the edge through the medium of the knife itself.

When the edge of the sore is dark, stiff, and dry, it is best to remove any pieces under-run with pus by means of the forceps, and to apply, two or three days running, some pure carbolic acid, with a little friction, on the skin around the outer side. This prevents the disease from extending, and hastens separation of the diseased edge. The carbolic acid should never be applied to the sore itself, but only to the skin at its edge.

Soap and water containing pheuyle or other disinfectant are necessary at every dressing to remove pus and discharge from the adjacent skin. Vaseline may be smeared below a discharging sore to save the skin.

Boric acid powder serves to protect the open sore left, or, if there is a cavity, a plug of tow saturated with Carbolised Oil. As soon as all necrosed tissue has been separated the discharge of pus ceases, and healing is rapid. If possible, keep the camel isolated for a week or ten days after all pus has ceased to form so as to give any other lesions time to show themselves before it rejoins the healthy camels.

The disease is not very dangerous to life if properly treated, but it is such a nuisance when it occurs that every precaution should be taken at once to prevent its spread. Ignorant dressers are very liable to spread the disease.

“ Fly-Blow.”

Although all untreated wounds are liable to fly-blow (maggots) in hot countries, there is one condition, which occurs in camels in Jubaland, that I never saw in India. This occurs after rain. Fatal results can be prevented if camelmen keep their eyes open at these seasons and report at once on finding any lesion.

The larvæ either pierce the skin itself or get access to the tissues through the punctures made by ticks such as *Amblyomma* (bont-tick), because there is no other wounding observable. The seats of the lesions were always just below the anus, or on the scrotum, or in the groin. The larvæ burrow in and make enormous stinking cavities. It often takes an hour or so to remove the maggots on the first dressing, and is filthy work. Treatment must be thorough, and is the same as that for fly-blown wounds. After removal of all maggots syringe well with 5 per cent. carbolic acid solution twice daily until healing begins, when Pheuyle is sufficient. Between dressings plug the cavity with tow saturated in carbolised oil.

Filariasis.

So far I have only met with three camels carrying filarial embryos in their blood here, and all were Arabs, so that it may be an Arabian filaria and not a native one. It has not yet been seen in a Somali camel. Two of these cases had their blood examined on 11 and 26 days respectively, but these were not always consecutive days. The embryos were not present at every examination: in the first camel only six times and in the second nine times. There was a marked variation in the number of embryos from day to day, but they caused no fever on their appearance. They remained from one to four days in the blood, and the intervals during which they were absent ran from two and a half to five days. Unfortunately a sufficiently well stained permanent preparation was not obtained; in fresh preparations the

embryo moves from one place to another on the slide with apparently purposeful movements. In two of the camels the filariasis did not affect their staying power on safari; in the third there was also trypanosomiasis, and the camel broke down on safari.

In India the filarial embryo has a sheath, shows no marked variation in numbers from day to day, causes no fever, and is only serious when in enormous numbers, in which case the affected camel is merely unthrifty.

In Egypt the embryo (as illustrated by Mason) shows no sheath; the parasites appear in the blood only at intervals, and cause fever when they appear, and the camel thus affected is apt to break down on safari.

The filariasis found in the Arab camels appears at intervals, but causes no fever. Its identity with either the Indian or the comparatively serious Egyptian filariasis is at present unestablished.

The disease does not appear to be important in Jubaland.

Pneumonia.

The great majority of the cases I saw in Jubaland were young camels that had been worked too soon. If proper treatment is at once adopted most of them recover, but not otherwise.

Other Diseases of Camels seen were those common to all camel countries.

Parasites.

The following parasites, usually harmless, have been seen in camels here:—

Hæmonchus longistipes (abomasum).

Trichocephalus echinophyllus (large intestine).

Cephalomyia maculata ("camel-bot").

Onchocerca fasciata ("spiroptera" nodules in Arab camels).

Thelazia leesei (conjunctival sac).

Echinococcus cysts (much less frequent than in India).

DISEASES OF EQUINES.

Trypanosomiasis.

A trypanosome of the type of *T. congolense* has been met with in a mule and a donkey, and one resembling *T. pecaui* in a mule. I am noting everything connected with these cases for future report on further experience of the two forms of trypanosomiasis. It is quite possible that all three animals were affected when imported into Jubaland.

"Ulcerative Lymphangitis."

In November and December this disease appeared among ponies at Garbahari and Serenli. It took the form of ulcers generally in the hollow of the heels, in the armpit, groin, and about the dock, fetlocks and canons (occasionally and

secondarily in other parts of the body); and these are the parts on which ticks are usually most abundant. Owing to lack of men the ponies had been in a neglected state as regards grooming and "ticking" for some time before the outbreak, and for the same reason segregation could not be carried out.

The ulcers at first show a small area of necrosis, which quickly sloughs away, and thereafter discharge a little thin pus. In the heels the primary ulcers are often of dangerous depth, and may be fly-blown when first seen. In other parts of the body the ulcers sometimes show a swollen base, making the lesion resemble a wart. There is no cording of lymphatics, and in only one case was there any marked swelling of limb. The discharges of the ulcers contain the Preisz-Nocard bacillus, but the name "ulcerative lymphangitis" seems to be a misnomer, and to give rise to confusion in the lay mind with "epizootic lymphangitis," a much more serious disease. In spite of the presence of a bacillus resembling the Preisz-Nocard bacillus both in this contagious ulcer of the horse and in "Gub" of the camel, the symptoms have not a great deal in common. Mules are markedly more resistant than horses, but are not immune.

TREATMENT.—Segregation under syces who do not touch healthy ponies; dressers must disinfect hands and instruments after every case before going on to the next, and should not handle the animals more than is necessary. The syce must do the handling, but should not touch the lesions.

If a slough is still present, it and any maggots present can generally be removed with forceps. At first a good dressing is 5 per cent. carbolic acid, with boric acid powder applied afterwards as a protective. If there is a deep cavity a plug of tow saturated in carbolised oil makes the best dressing. Later, when the discharge is slight, I obtained the best results with a 4 per cent. solution of copper sulphate, and found healing very slow with other drugs. Further experience may reveal a better line of treatment.

PREVENTIVE MEASURES.—I am convinced that the organism obtains an entrance somehow in connection with tick-bites. In Northern Jubaland the removal of ticks should be part of the daily routine of grooming.

Ornithodoros savygyini was found at a place between Garbahari and Lolashid. This is the tick suspected by Drake-Brockman of causing relapsing fever in man in Northern Somaliland.

Kismayu,

(Signed) A. S. LEESE,

31st March, 1914.

Veterinary Officer.

REPORT ON DOUBLE INOCULATION
AGAINST RINDERPEST AT LUMBWA,
FEBRUARY, 1914.

On February 19th I proceeded to Lumbwa, carrying with me a bottle of virulent rinderpest blood obtained from a Uganda control at the Laboratory. The following morning this was inoculated into four young bullocks which had been obtained from Mr. Chamberlain's farm at Elementeita, and which were housed on Mr. H. E. Watts' farm at Lumbwa.

It was anticipated that these cattle would react to the inoculation on the following Tuesday, and that their blood would be available for use on Wednesday, Thursday and Friday.

Subsequent to the inoculation, and prior to the reaction taking place, I was able to visit most of the farms in the vicinity, and to obtain from the owners a definite statement as to the numbers of cattle, both their own and those belonging to native squatters, to be inoculaed on their farms. Mr. U. Jones alone stood out, though owing to his absence from the District I was unable to have a personal interview with him.

In addition to these visits a circular was circulated to all neighbouring stockowners asking them to meet me at the Dak Bungalow on Sunday, when, in addition to obtaining a confirmation as to the numbers of animals, I was able to inform them as to the definite arrangements that had been made for the inoculations.

The Veterinary staff available for the carrying on of this work consisted of Messrs. H. Brassey-Edwards, Dixon, Henderson, Schultz, Branwhite and Bailey, and we counted upon the ready assistance of all owners, in particular, Messrs. Watts and Cameron Brothers.

The work allocated to these officials was as follows:—

	Wednesday.	Thursday.	Friday.
Messrs. Dixon and Bailey	Martin and Barclay, 295	R. H. Wilson, 171	Mr. Dixon left for Masai Reserve.
	Le Breton, 247	Clift 247	
	McCreary, 91		
Mr. Henderson	Cameron, 800	Cameron 526	Mobberley 318
		Joubert 47	
		Nottage & Price 58	
Mr. Branwhite	Isaacson and Miles 142	Carr and Hannigan 384	Carnegie 542
	Squatters of above 120		
	Cushney, 268		
Messrs. Brassey Edwards and Schultz	Watts. 617	Cocker, 473	Government, Indian, Native, Trade and other Township Cattle 253
		H. Smith 146	

The necessary serum was despatched to the farms on which crushes had been erected. Native runners slept at Mr. Watts' farm on the night prior to the inoculations at their master's farms, and the blood was drawn in the early morning and despatched by these men, so that it could arrive and be ready for use at daybreak.

The Departmental Officers stayed on the farms, and were ready for work immediately on arrival of the blood.

These arrangements were most satisfactorily carried through by both officers and owners, and all inoculations were completed within the specified and pre-arranged time without the occurrence of any hitch.

Mr. Brassey-Edwards, Mr. Schultz and I returned from Lumbwa on Friday, February 27th; Mr. Braithwaite followed on Saturday, and Mr. Henderson and Mr. Bailey remained in Lumbwa to watch the course of the disease following inoculation.

In expressing my thanks to the stock-owners of Lumbwa for the successful way in which the operations were carried out, and for the hospitality they extended to all officers, I particularly thank Messrs. Cameron Brothers and Mr. Watts for the energetic way in which they assisted, not only on their own farms, but on those of their neighbours.

I returned to Lumbwa on March 19th, and was able to meet nearly all owners at a meeting of the Lumbwa Farmers' Association held on Sunday, the 22nd.

Of the five thousand seven hundred and forty-five cattle inoculated there has been a total mortality of thirty-seven. In this total I have included all animals which succumbed within three weeks of the injections, many of which died from other causes (killed in crush), East Coast Fever, probably Tympanitis, etc.), and should not be attributed to rinderpest. Others, again, probably seven, succumbed to redwater, but as it was known that the virus of this disease was also present, these must be ascribed to the inoculations.

The attached table shows in detail the classification of the stock in the Lumbwa district, and for the purposes of statistics each owner submitted the numbers of his animals in each class which he knew had never been exposed to rinderpest, and would therefore be susceptible. This cannot, of course, be accepted as entirely accurate, for, as will be observed, one death from rinderpest occurred in work oxen which were recorded as immune.

Bulls.—Thirty-four bulls, of which thirteen were susceptible, have all passed through the disease well. Of this latter number two were imported pure-bred animals, and the reactions in them were normal. There were no deaths.

Cows.—(a) *In-calf*. Seven hundred and sixty-nine, of which four hundred and thirty-two were susceptible. The reactions were normal, and there were no deaths.

(b) *Heifers in Calf*. Four hundred and ninety-eight, of which three hundred and five were susceptible. Reactions normal; no deaths.

(c) *Cows not in Calf*. Six hundred and ninety-three, of which two hundred and forty-three were susceptible. Reactions normal; no deaths.

Up to the time of my visit four abortions had taken place on Messrs. Cameron Bros. farm out of a total number of four hundred and forty-five in-calf animals. I discussed with the Association the probability of more abortions taking place, and although the general view is that very few are anticipated now that the reactions are over, I prefer to wait for three months before compiling returns under this heading.

I ascertained that the average weekly yield of milk supplied by the owners of the inoculated cattle amounted to Rs. 612/25. During the week of March 1st to March 7th, the time when the reactions were at their height, this decreased to Rs. 556/96, or a percentage of 9.09. In the following week the yield returned to normal.

Work Oxen.—One thousand three hundred and eighty-one were inoculated, of which four hundred and thirty-three were susceptible. The reactions were good, and the single death occurred in Messrs. Carr and Hannigan's mob, all of which were believed to be immune.

Young Stock.—The total number inoculated was one thousand one hundred and seventy-seven, of which one thousand one hundred and forty-eight were susceptible. The reactions in this class of stock were rather more severe than in any other, and the total deaths recorded are twenty, or 1.74 per cent.

Calves.—Eight hundred and twenty received the inoculation, of which eight hundred and nine were susceptible. Distinct temperature reactions followed, though the clinical manifestations were mild. Sixteen deaths, or a percentage of 1.9 occurred, of which several were due solely to redwater.

Considering the whole figures it will be seen that the total death rate amounts to 0.6 per cent., or, taking only the susceptible stock, to 1.09 per cent.

It is extremely gratifying to find that our anticipation of success with the active immunisation against rinderpest has been borne out in this large field experiment. By the use of "serum alone" enormous wastage of time and serum occurs. Lumbwa, by its double inoculation, is now secured from further outbreak until succeeding generations of stock have been reared.

In view of this test I consider that the time is ripe for Government to seriously contemplate the active immunisation of all cattle in the dangerous areas of the Protectorate.

(Signed) R. EUSTACE MONTGOMERY,

Veterinary Pathologist.

Name.	Total Inoculations.	Total Deaths.		Bulls.		Cows in Calif.		Cows not in Calif.		Heifers in Calif.		Work.	Deaths.	Oxen.	Young stock.		Deaths.		Calves.		Deaths.
		A.	B.	A.	B.	A.	B.	A.	B.	A.	B.				A.	B.			A.	B.	
H. Smith	146	1	...	6	...	15	...	12	...	47	...	...	...	...	...	...	...	...	...	...	...
Cushney	268	3	...	11	...	27	...	22	...	33	...	...	...	...	...	...	...	...	...	...	...
Cocker	473	2	...	4	...	21	...	27	...	10	...	...	...	...	...	...	...	...	...	...	...
Martin and Barclay	295	3	...	40	...	21	...	48	...	65	...	...	...	...	...	...	...	...	...	...	...
Le Breton	247	3	...	23	...	20	...	28	...	10	...	...	...	...	...	...	...	...	...	...	...
McCreary	91	2	...	13	...	12	...	26	...	82	...	...	...	...	...	...	...	...	...	...	...
R. H. Wilson	171	1	...	4	...	4	...	5	...	22	...	...	...	...	...	...	...	...	...	...	...
Clift	171	1	...	1	...	26	...	8	...	20	...	...	...	...	...	...	...	...	...	...	...
Carr and Hounigan	247	...	...	8	...	25	...	8	...	8	...	...	...	...	...	...	...	...	...	...	...
Nottage and Price	384	3	...	1	...	33	...	20	...	87	...	...	...	...	...	...	...	...	...	...	...
Joubert	58	1	...	40	...	...	...	...	...	220	...	...	...	...	...	...	...	...	...	...	...
Cameron	47	...	...	1	...	...	...	...	...	6	...	...	...	...	...	...	...	...	...	...	...
Mobberley	1,326	...	...	1	...	4	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Carnegie	318	9	...	32	...	137	...	100	...	131	...	...	...	...	...	...	...	...	...	...	...
Isaacson and Miles	542	1	...	275	...	91	...	45	...	16	...	...	...	...	...	...	...	...	...	...	...
Watts	142	4	...	45	...	41	...	53	...	104	...	...	...	...	...	...	...	...	...	...	...
Township	617	1	...	79	...	87	...	22	...	58	...	...	...	...	...	...	...	...	...	...	...
Isaacson and Miles'	253	1	...	36	...	38	...	38	...	126	...	...	...	...	...	...	...	...	...	...	...
Squatters	120	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...
Total	5,745	37	21	13	337	432	450	243	193	805	948	1	433	29	1,148	20	11	809	16	...	...

"A." Cattle which are believed to have been previously exposed to Rinderpest.

"B." " " never to have previously been in contact with Rinderpest.

ANNUAL REPORT

ON THE

VETERINARY PATHOLOGIST

FOR THE

FINANCIAL YEARS 1912-13 AND 1913-14.

THE CHIEF VETERINARY OFFICER,

NAIROBI.

SIR,

I have the honour to submit my fourth and fifth annual reports as Veterinary Pathologist, for the financial years 1912-13 and 1913-14.

As I emphasized in the report for 1911-12, it is becoming increasingly difficult to restrict my remarks to the work carried on during a prescribed period, except in so far as duties of a routine and administrative nature are concerned. The technical work of a research character is often prolonged over a period of several years, and it is impossible to furnish data that is likely to be of benefit to the stockowner if only certain fixed periods are dealt with.

More particularly is this the case for the years under review, as owing to my absence in South Africa, and my departure on leave, it is only possible to deal with the diseases under investigation in a general manner.

The amount of research being conducted is very considerable, and owing to various limitations, especially in the way of accommodation and trained assistants, and by nature of the diseases under investigation, and the claims of the public on the institution, it is not possible to concentrate our energies upon any one condition in a way that is to be desired, nor to apportion each line of investigation to an assistant, as is usually done in research laboratories.

I regret that I have not been able to submit this report at an earlier date, but since my return from leave the large output of anti-rinderpest serum demanded for use in the Union and other African Colonies, has largely monopolised our time, nor have I yet been able, as I had hoped, to issue independent progress reports on diseases which we have had under experimentation for the past few years.

Viewed from a stockowner's standpoint, research must have one of two objectives—prevention or cure.

The number of local conditions of which this can be said is as yet limited, though I am happy to say it is increasing annually, and since the back of the necessary preliminary investigations is now broken it is hoped that more rapid progress to these ends will now be possible.

In veterinary work the profession is handicapped by the question—supreme in every owner's mind—of expense, or what is almost the same, trouble. It is of no real value to an owner that we can say a preventive inoculation is possible, but its expense, or the difficulty inseparable from its administration, is so great as to render the method impracticable. Our medical confreres are much less restricted in this way, for the saving of a human life is looked upon as an end to be attained by any means, and measures practicable in medical work are inapplicable when large numbers of stock are involved. This is an aspect commonly overlooked by the owner.

In most of our animal diseases we have reached a point where prevention or cure can be effected, but only at an expenditure of time or money which few would contemplate. Our efforts in these, therefore, are now being focussed on obtaining equally satisfactory results by a more practical system, and one capable of application in the field.

There is one other aspect of our work to which I would direct an owner's attention. The diseases of East Africa, although in certain ways similar to those obtaining in other countries, are in very many cases totally different when the question of prevention by inoculation is considered. Immunity and resistance on the one side, and hypersusceptibility on the other are factors which naturally modify the diseases here, and it is necessary therefore that we decline to accept as satisfactory here methods or lines of treatment advocated by other workers merely because they have been found applicable in other parts of the world.

As an instance of this I may mention swine fever, a disease which in America and on the Continent of Europe can be, and is being, controlled by the use of an Anti-Swine Fever Serum. In this Protectorate the disease is of such extraordinary virulence that serum obtained from the leading laboratories and demonstrated here to be efficacious against the disease of the country of origin, has been found absolutely valueless against the East African form.

Again may be cited anaplasmosis. In the Transvaal an inoculation by means of a mild strain of the disease is extensively practised, and with excellent results. The same inoculation has been found of no value in Rhodesia.

Horse sickness is another and even better example. In this, a horse can be immunised with confidence against the disease of one locality, yet this animal may succumb if exposed to the horse sickness of a different district.

Veterinary literature furnishes many similar instances, even in the long studied diseases prevalent in Europe, and the position that must be embraced is that each country shall specialise in the disorders obtaining within its borders, and the measures of repression to be taken must be moulded to coincide with the requirements of that particular country. This, of course, implies that in a new country the pathology of a disease must be worked through from the beginning, so that we can learn just how much responds to that observed elsewhere, and also the points of difference, before a policy of repression or suppression in a laboratory sense can be formulated.

In East Africa we have also to contend against diseases so different from those in other countries as almost to constitute distinct entities. In some cases, as for example in that of East Coast Fever, this is due to an immunity enjoyed by the adult stock of certain districts, an immunity due, so far as our knowledge at present goes, to the local conditions obtaining therein. In swine fever, on the other hand, our severe mortality is not due to the hypersusceptibility of the local pig, for these animals respond normally to the disease of Europe, but to an increased virulence on the part of the causal germ.

Exactly where an extremely modified disorder becomes a new disease would be difficult to define, but the fact remains that in the literature of veterinary pathology we find no indications of such conditions as "Nairobi Sheep Disease," "Kikuyu P'owl Disease," "Uasin Gishu Skin Disease," and others as yet un-named.

The corollary is that in a country such as this the whole pathology of a disease must be elucidated both in the Laboratory and the Field before it is possible to arrive at any adequate means for preventive or curative treatment.

This has been the policy which has been carried out here since my appointment, and it is only now that we are reaching the stage at which "results" are beginning to arrive. The mere detection of the causal micro-organism or virus is usually of small interest to a stock-owner, unless at the same time he can be told whence it comes, how it operates, and how best it may be killed. Such enquiries take up much time and money, but I am pleased to report that Government assistance has been very materially increased during the years under review, and our work is progressing at a more rapid pace in consequence.

It will, I trust, be possible within the ensuing year to publish reports on such phases of Rinderpest, Swine Fever, Navel Ill in Young Stock, Epizootic and Ulcerative Lymphangitis in equines, Nairobi Sheep Disease, Uasin Gishu Skin Disease, and Wireworm in Sheep as have been fairly conclusively elucidated, and though we are not yet in a position to add final conclusions as to cure or prevention, such deductions as are possible may indicate to stockowners the lines upon which better results may be obtained.

I would take this opportunity also of again advocating the issue of a research report. Our duty is primarily to the stock-owner of the Protectorate, but secondarily to those Veterinarians engaged in collateral research in other parts of the world, and a free interchange of views is most desirable from every standpoint. The material for this will be submitted as soon as the necessary time can be given to the subject, and will consist of the more technical side of our work on those diseases already enumerated, on which I hope pamphlets for stockowners may be issued, and on such conditions as at present possess only scientific or academic interest.

Early in April, 1912, I proceeded to South Africa to consult with Dr. Theiler on the question of inoculation against East Coast Fever, and to see his method in the field. One month was spent in that country, of which a fortnight was devoted to field observations in the Transkei Native Territories, and the same period at the Pretoria Laboratory. An epitome of my report to you appears under the heading of this disease. During my absence Mr. W. Kennedy assumed charge of the Laboratory.

I proceeded on leave at the beginning of November, and travelled home via the Sudan and Egypt in order that an insight into the Veterinary Administrations of these neighbouring countries might be obtained.

During my stay in England I availed myself of Sir Stewart Stockman's kindness in permitting the use of his laboratory for a continuation of our investigation into Swine Fever. Three and a half months were spent in London on this work, which, unfortunately, did not yield the practical results hoped for, though our knowledge of the pathology of the disease was increased.

I returned to Nairobi on June 14th, 1913.

Personnel.

During my absence on leave Mr. F. R. Brandt officiated as Acting Veterinary Pathologist, and carried out the duties in an extremely able manner.

Owing to Dr. Hannigan's resignation early in 1912, the post of Assistant Veterinary Pathologist became vacant, and no candidates being forthcoming the appointment remained unfilled throughout the year 1912-13. During my leave I was able to select Mr. W. Kearney, a member of the Royal College of Veterinary Surgeons, for this vacancy. Mr. Kearney arrived in East Africa on August 6th, 1913. The appointment has relieved me of a very considerable amount of routine work, and has permitted me more liberty to visit outbreaks of disease occurring near the railway.

CLERICAL STAFF.—Mr. Galway proceeded on leave after thirty months' service on March 24th, 1913, and returned on October 1st, 1913. Mr. Walker joined as stenographer and typist on October 3rd, 1912, and during three months of Mr. Galway's absence Mr. J. W. Johnson was transferred from the Administrative Office.

LAY ASSISTANT STAFF.—Messrs. Maule and G. Scott were replaced by Messrs. O'Mullen and Burton, the latter assuming the duties of Overseer on June 5th, 1912.

On the arrival of Messrs. Schultz and Cairns in October, 1912, as Laboratory Assistants, Messrs. Branwhite and O'Mullen reverted to the Stock Inspector's establishment. Mr. C. J. Scott was appointed locally on August 12th, 1913, and Mr. E. W. Gray arrived here from the Pretoria Laboratory on February 22nd, 1914.

The appointment of these Assistants has done very much to facilitate the progress of our work, since a helpful knowledge of Laboratory technique cannot be acquired during a stay of a few months, and as has been pointed out in previous reports, the locally appointed Stock Inspector is, as a rule, anxious to obtain a more remunerative or permanent appointment than was formerly offered.

It became necessary to obtain the services of a Storekeeper, and Mr. S. G. Watkins held this office from September 1st, 1913, to his resignation on March 31st, 1914.

LABORATORY STUDENTS.—This grading was introduced during the year 1913-1914, and is intended to permit of the sons of settlers acquiring laboratory experience soon after they leave school. No organised tuition is given, but opportunities are offered for a thorough insight to be obtained of all the work. Such training will be invaluable for those who may subsequently wish to enter the veterinary or other scientific professions, or who desire to obtain posts in similar laboratories.

Mr. R. E. Hoddinott arrived on October 8th, 1913, and Mr. E. Duirs on January 3rd, 1914.

It is most gratifying to again record the enthusiasm and good work of every member of the staff; one and all have co-operated heartily in the work of the Institution. I would especially thank Messrs. Brandt and Kennedy for the excellent way in which they carried out the manifold duties of the appointment during my absences.

Correspondence.

In 1912-1913 a total number of 6,873 inward and outward letters has been dealt with, an increase of 2,316 on the previous year.

In 1913-14 the number dealt with was 9,162.

It has not yet been found possible to divide the clerical work so as to permit the services of one man to be devoted to the compilation of Laboratory records and the maintenance of purely technical data. This is a most desirable arrangement, and will permit of our results being made available to stockowners with the least possible delay.

Laboratory Buildings and Equipment.

During the year 1913-14 an extension to the Laboratory, primarily for serum manipulation, was erected. This wing is slightly larger than the original building, and consists of a Bleeding Hall, Centrifuge and Serum Room, together with the necessary sterilising and storage accommodation to cope with our present output of serum.

Steam, gas and electrical power as also being installed, and when completed this additional equipment will enable our productions, especially that of Anti-Rinderpest Serum, to be carried out more economically and under far better conditions than is possible to-day.

The accommodation for livestock is gradually becoming more complete, though not in ratio with the increase of animals under observation, nor the number of diseases on experimentation. Many conditions require rigorous isolation, and this at the present time is a matter of extreme difficulty, and is only rendered possible by restricting the number of animals employed, a policy detrimental to the success of our work.

The question of feeding stuffs, especially forage, has been one of considerable difficulty and anxiety. The amount available in the country is as yet very variable, and dependent upon seasons and the demand from individual owners, who are more and more recognising the desirability of artificially feeding their animals at certain seasons. I consider that conditions are as yet not sufficiently mature for us to be able to rely upon the local market, and I strenuously urge that we should cultivate the major portion of our requirements. I believe that this could be effected more economically, and it is certain that our produce would be obtained under conditions that would eliminate other diseases from the stock—a factor concerning which we cannot now be so confident.

By a recent compromise some 350 acres of land situated on the railway and opposite the Laboratory is to be handed over for our use. I have every hope that this will prove sufficient for our ordinary demands for grazing and cultivation. I must, however, point out that this does not afford us additional security against disease, or provide isolation for cattle which are waiting for experiment, and should the present demand for Anti-Rinderpest Serum continue, it may be necessary to obtain the use of land well removed from the disease in order to safeguard these animals. We have on two occasions suffered loss through the introduction of rinderpest to our healthy cattle, and on each it was only the most careful scrutiny and the fortunate arrival of more stock that enabled us to continue the work without serious interruption.

LIVE STOCK.

1912-1913.

	Remaining on books. 31-4-1912.	Received during year. 1912-1913.	Total for year.	Remaining on Books. 31-4-1913.
Horses	4	12	16	7
Mules	2	9	11	4
Donkeys	7	12	19	9
Cattle	402	312	714	263
Sheep	92	243	341	85
Goats	3	20	23	7
Pigs	50	93	143	25
Total	566	701	1,267	400

1913-1914.

Horses	7	24	31	15
Mules	4	17	21	9
Donkeys	9	1	10	8
Cattle	263	717	980	510
Sheep	85	238	323	213
Goats	7	26	33	5
Pigs	25	71	96	20
Total	409	1,094	1,494	780

The Technical Work.

ROUTINE.—In the year 1912-13, 3,151 slides and specimens were received from members of the Veterinary Department and from private owners. This number shows a slight diminution over the previous year.

In 1913-14, 2,811 specimens were reported on.

Rinderpest.

The amount of Anti-Rinderpest Serum issued during the year 1912-13 was 125,418 doses, and in 1913-14, 201,148 doses. These figures may be compared with an issue of 97,959 doses in 1911-12, and 14,155 in 1910-11.

During the period under review an attempt has been made to improve the value of the serum obtained by the injection directly into the jugular vein of the virulent blood, and later by transfusion directly from vein to vein. The serum so obtained has been equally potent to that made by subcutaneous injections, and the simplicity of the transfusion technique renders it especially desirable in laboratories where there are not many assistants. It has the further advantage of eliminating abscess formations,

which often follow subcutaneous injections, and which preclude the use of the affected animal. The disadvantage, however, is the mortality which occurs from the operation.

The estimated rate of transfusion, a figure obtained from numerous observations, is 500 c.c.s. per minute, the amount transfused ranging from 2,000 to 4,000 cubic centimetres, being dependent upon the number of times an animal has previously been hyperimmunised.

Approximately 25 per cent. of animals transfused or injected with virulent rinderpest blood intravenously manifest symptoms of suffocation during the operation, in many cases even when only small quantities of blood have passed into the vein.

Of the total number so injected, about 16 per cent. have died. In the majority of instances death occurs within a few minutes of the commencement of the operation. A few animals have manifested no symptoms at the time of injection, but have succumbed within the ensuing twenty-four hours. In nearly all these oxen the post mortem lesions have been similar, the outstanding lesions being markedly engorged lungs, a profound oedema of the fourth stomach, often accompanied by hæmorrhage, a bleeding into the intestines and into the serous cavities of the body.

The cause of this condition cannot yet be defined. On various grounds mechanical reasons such as undue distension of the circulatory system arising from the injection, the presence of air and other similar explanations can be excluded, since the mortality bears but small ratio to the amount injected. Symptoms and death have followed the transfusions for only thirty seconds, *i.e.*, 250 c.c.s.

On the other hand I am not yet prepared to assert that the factor known as Anaphalaxis is responsible. This is a condition which has attracted very considerable attention within recent years, and is primarily due to a state of the body having, by contact with certain animal constituents, acquired a great susceptibility to a further injection of the same constituent. Applying this to our present problem: An animal on first being inoculated with the rinderpest virus acquires a peculiar susceptibility to a subsequent and larger injection given at a date some time later.

The symptoms and post mortem appearances are comparable to Anaphalaxis or "Serum Disease"; but it is yet difficult to understand why the mortality should only occur as a result of intravenous injections. In the very large number of subcutaneous and intramuscular injections such symptoms have never been noted.

Various measures have been attempted to prevent the onset of symptoms, such as bleeding an animal the amount, or more than the amount subsequently to be injected; starving for at least twelve hours prior to the operation; the administration of Adrenalin as a precautionary measure, or after the onset of symptoms. It cannot, however, be said that any one or any combination of these has been an entire success.

Of 190 transfusions or intrajugular injections 33 animals have died—ten after the first hyperimmunising, thirteen after the second, and ten after the third.

Opportunity has recently occurred for controlling this operation upon cattle other than serum-makers by the injection of blood of animals susceptible to rinderpest, and therefore not containing this virus.

Six cattle which had been immunised to rinderpest by the simultaneous method in November, 1913, were utilised and were transfused with blood of healthy cattle, the susceptibility of which to rinderpest was proved by their subsequent inoculation as controls.

The routine doses of blood were transfused, namely 6 c.c.s. per kilogramme live weight on the first occasion, 9 c.c.s. per kilo on the second and 12 c.c.s. per kilo on the third. These transfusions were carried out at intervals corresponding to the time usually elapsing between the hyperimmunising in the case of serum-making cattle.

Five animals successfully withstood all three transfusions. One weighing 230 kilogrammes succumbed two hours after transfusion with 2,070 c.c.s. healthy blood, the rate being 9 c.c.s. per kilo. The symptoms manifested and the post mortem appearances noted were quite similar to those occurring when rinderpest virus is transfused.

Owing to the mortality due to intravenous transfusion it was decided to suspend that method of hyperimmunising until more knowledge of the subject was available, and for the past eight months all routine injections have been carried out intramuscularly. During my visit to Cairo I was greatly impressed by the simplicity and efficacy of the technique in vogue there, and on my return from leave a modification of their method was put in practice.

The results have been eminently satisfactory. Abscess formation is exceedingly rare, and the potency of the serum obtained is equal to that yielded by other methods.

Rinderpest serum production has again largely absorbed our time, but during the past year I am glad to report that the opening of a Treasury Suspense Account has very materially alleviated our anxieties, and has enabled a portion of the much-needed housing accommodation for animals to be erected, besides allowing of greater facilities for the proper manipulation and storage of serum.

A very large number of experiments have been carried out with a view to ascertaining the most economical and efficient system of serum production, and the class of animal from which the most potent serum can be obtained.

Experimental work has also been largely directed to perfecting a system of double or active inoculation applicable to all the cattle in the Protectorate.

Until some such can be adopted, continual recrudescence of the disease must be anticipated, and an adequate reserve of serum and the necessary staff be maintained at a perpetual expense.

The chief difficulty in applying the simultaneous inoculation for the production of active immunity is that of obtaining a pure uncontaminated virus of the disease the virulence of which will remain during transportation to various convenient centres.

For the obtaining of a pure virus some preparation of the blood would be required in order to eliminate such constantly present parasites as Red Water and Anaplasmosis, and the possible, though improbable presence of Trypanosomiasis. There does not yet appear to be any other disease of which we need be afraid. On the successful accomplishment of this hinges the as yet unsettled pathological problem of which constituent of the blood harbours most the Rinderpest virus. The serum portion could easily be obtained free from other diseases, but the red blood corpuscles in which the virus is presumed to lie by predilection, are with great difficulty obtained free from such contained parasites as Anaplasma.

The second problem to be solved is to obtain a virus constant in its virulence. Operating at the Laboratory we believe that this is commonly of one strength, but I am of the opinion that variations have occurred in the course of our experiments, and this has at times somewhat interfered with the deduction we expected to draw from certain experimental observations.

We are now attempting a method of standardisation by passing the rinderpest virus through animals other than bovines, and should this prove successful the future outlook will be considerably improved.

The third difficulty against universal active inoculation lies in the easy destructibility of the rinderpest virus. Whereas Horse Sickness, Swine Fever, etc., can be preserved in a bottle for months, and even years, without alteration of virulence, Rinderpest dies under similar conditions within a few days. When specially maintained on ice the virulence remains longer, and it is claimed, has been proved effective for upwards of six weeks. The practical difficulty of transporting ice chests for several days away from the railway will be apparent, since there is no perfected system of retaining the low temperature for more than twenty-four hours after the supply of fresh ice is exhausted. This is also a point to which our enquiries are directed, and experiments have been made, and are now being carried out, with a view to finding suitable means of preserving an unalterable disease virus.

Our observations were sufficiently mature by the end of 1913 to warrant a recommendation that the double inoculation be again brought into practice. It will be recollected that this had formerly been carried out on farms in the Lumbwa and Molo districts, but owing to a rather serious mortality on two farms, the cause of which could not be satisfactorily explained, further outbreaks of the disease were controlled by the use of serum alone.

In February, 1914, a total number of 5,475 cattle owned by settlers in the Lumbwa district were submitted to the double inoculation. All classes of animals were included, and a total of 3,383 were highly susceptible to the disease.

The total mortality from all causes was 37, or 0.6 per cent., and among the susceptible stock 1.09 per cent.

Of 737 females in calf there have occurred 38 abortions. The slipping of calves after Rinderpest, whether in a natural outbreak or as a result of the inoculated disease, is a very important and sometimes serious sequel, and one which as yet we imperfectly understand.

From a dairyman's point of view it is interesting to note that in the week subsequent to the inoculations the milk yield decreased by 9 per cent. In the following week it again returned to normal.

The experience gained by this large field experiment will be of the greatest assistance in furthering the policy of active immunity as a means of eradicating Rinderpest. But though successful, the methods employed are not all that can be desired from an economic standpoint, and it is hoped that further research may simplify or improve the technique.

Research has within recent years thrown much light upon the factors underlying the practice of treatment and prevention by means of sera and vaccines. Unfortunately we are not as yet fully able to avail ourselves of the opportunities offered for comparing the results obtained in other diseases against what may be found for Rinderpest. This branch of science demands unremitting attention and the application of a quite peculiar technique for which we have no appliance until the completion and equipment of the new Laboratory extension. I believe that equally great practical results may eventuate from the employment of delicate sero-logical methods in this disease, and it is my hope that at no distant date funds may be made available for the employment of a worker in this field alone.

For the accurate standardisation of serum by the methods at present available, large numbers of cattle are required for each "brew" or mixture of sera of various animals collected over a given period. It is probable that a Laboratory test could be evolved which, when thoroughly tested on animals and proved efficient, would be substituted for that on animals, the expense of which in purchase and maintenance is very great.

Each brew of serum is at present tested on not less than twelve cattle—frequently more—to ensure freedom from deleterious qualities and to prove approximately the potency as an anti-disease agent, and so satisfy ourselves as to the efficacy at a given dose.

Opportunity presented itself during the current year of testing anti-rinderpest serum prepared in South Africa in 1902. Unfortunately at the time of the test only a very limited number of cattle were available, but the result arrived at was an excellent demonstration of the keeping quality of Anti-Rinderpest Serum.

Although the large dose of 100 c.c. was given it was clearly shown that much of the preventive qualities remained. This fact must not be lost sight of when considering the reserve of serum to be held by countries exposed to infection.

Rinderpest routine has again taken up the major portion of our time, and allowed but little opportunity for research into other diseases.

Unfortunately Anti-Rinderpest Serum cannot be manufactured until the disease has arisen within a country. In this respect it differs from many other conditions the virus of which can be safely and easily transported great distances so as to be ahead of the oncoming scourge. The history of this disease in the past has shown the tendency to southward extension, and it appears to be our duty to make use of such existing facilities as we possess for the benefit of those Colonies as yet free.

East Coast Fever.

Numerous observations were made as to the disease-carrying powers of the more common species of ticks found in the Protectorate. Among those experimented with are:—

Rhipicephalus appendiculatus (The Brown Tick).

Rhipicephalus evertsi (Red Legged Tick).

Rhipicephalus pulchellus (Yellow Backed Tick).

The first-named above has up to now alone been proved a conveyer of the disease in this country, although in South Africa *Rhipicephalus evertsi* has also been found culpable on a very few occasions. Considerable difficulty has been experienced in obtaining any information about the habits of *Rhipicephalus pulchellus*, the common tick of the Athi Plains. It is only very rarely that a few specimens out of hundreds of larvae applied have been found to feed on the animals applied, whether equines, cattle, sheep, dogs, rabbits, guinea-pigs or fowls.

Owing to considerable variation in the size and markings of *Rhipicephalus appendiculatus* being noted, I was at first doubtful as to the identity of many examples of this species, and care had to be exercised to deal with the progeny of each female at a time. This, of course, considerably multiplied the amount of detail and record work, but as Professor Nuttall, through the Entomological Committee, has shown us that variations are common in this species, subsequent observations have been more easy.

There still remains a great deal to be done in the mapping out of tick distribution in East Africa, and again I would ask all land and stock owners to interest themselves on our behalf and to apply for collecting tubes and directions.

The experimental work into the question of immunity in young calves and into the disease conveyed by inoculation has been somewhat interfered with by my absence, but it may be stated that no practical progress has yet been made in these directions, since the mortality and uncertainty of result has been too great for application in the field.

During my visit to South Africa I had an opportunity of discussing the feasibility of inoculation against this disease with Dr. Theiler, and of seeing the method in practice in the Transkei Native Territories of Cape Colony. At the time of my visit in May, 1912, some ten thousand head had been inoculated intravenously with a coarse emulsion of infected spleen mixed with peptone. Following the inoculation, herds were as far as possible kept on a clean area for about a fortnight, and were then moved to a heavily infected pasture and maintained there for six to eight weeks. It was found that approximately 20 per cent. of the inoculated animals died as a result of the injection, and a further 20 per cent. will not have acquired any immunity, and succumb during the period of exposure to the infected pasture. On an average 60 per cent. may be expected to survive all tests and be immune.

In South Africa, where the mortality from the natural disease exceeds 95 per cent., this is a marked step in the direction of progress. The injection might be applied to clean farms in this Protectorate on which highly susceptible stock of considerable value were running, and on which it was impossible to adopt any such measures as de-stocking or dipping. But for the average owner of mixed stock this mortality is too great, and a universal system of inoculation cannot be thought of under existing conditions.

The policy of inoculation as the sole means of eradicating the disease cannot receive much support. It is obvious that it can only be carried out in the centre of infection when actually sick cattle occur, and the resulting reactions, as well as the necessary testing areas, serve to perpetuate the disease, which will be further maintained by newly-born calves and by such animals as may break down in immunity. The method serves to reduce the mortality from the disease in an already infected area, and in this sense deserves consideration in East Africa, but in South Africa the object is complete eradication, and for this, inoculation must be supported by the usual rigorous quarantine restrictions and by furthering tick destruction. The co-operation of the Native Reserves in South Africa is comparatively easy, and, in fact, an additional hut tax of half a crown was levied in Pondoland for the purpose of raising funds for the erection of dipping tanks.

During the year 1912-13 considerable discussion took place at various Farmers' meetings on the subject of a freer movement of cattle within the districts classed as infected, and from one such district into or through the clean Rift Valley. The evidence adduced by the interested "open door" party against the disease being capable of obtaining a foothold in the Rift Valley could not be contradicted by the other section, whose argument, by reason of the case, was a negative one.

Tentative experiments at the Laboratory showed that the oviposition of *Rhipicephalus appendiculatus* and the hatching of the young was not impeded when the mature females were placed on soil obtained from Naivasha. This result, however, was of little practical value since areas in Africa are known where, although the tick thrives well, the disease does not spread.

After considerable contemplation it was decided to attempt the infection of paddocks at Nakuru and Naivasha.

The results obtained have clearly proved that East Coast Fever can obtain a footing in the Rift Valley, and that the Veterinary Department must continue to exercise that control on movement which has kept the area clean in the past.

Within the past twelve months much progress has been made towards the establishment of a universal dipping scheme. The adoption of this method of tick destruction has everywhere proved itself most satisfactory, not only in the control of East Coast Fever, but also against Anaplasmosis and Redwater.

Anaplasmosis.

We have considerable evidence that a large number of cases of this disease have occurred within the past two years, and it is increasingly apparent that it is a serious menace to the importation of stud cattle from Europe. The mortality in imported stock was frequently looked upon as being due to an acute or a sub-acute infection with Redwater, but practically all cattle now imported are previously immunised to that disease.

That the disease occurs throughout the Protectorate is evident, since, practically speaking, all country bred cattle are immune as a result of infection during calthood, and in our experiments we have failed to reproduce the disease by inoculation into such. The immunity may, however, as in the case of Redwater, break down in the course of other diseases, and for this reason a Laboratory return of "Anaplasmosis" does not necessarily signify that it alone is responsible for the sickness, though such a report should make an owner adopt the usually recognised, though not entirely satisfactory, treatment with Calomel, Epsom Salts, Quinine and stimulants, and, above all, careful nursing.

Theiler in South Africa has demonstrated the existence of two strains of the causal parasite—*Anaplasma marginale* and *Anaplasma centrale*. The latter he has shown to be of a milder variety, capable of conferring immunity against the more serious marginal form. This view has received considerable support in various parts of the South African Union, but in Rhodesia the experiments have not been attended with success.

In East Africa I believe that both varieties are present, but we have not yet succeeded in separating them.

In November, 1912, we received from England some Ayrshire cattle for the purpose of carrying on the strain of *centrale* to be received from Pretoria. Unfortunately no success then attended the experiment, as the virus was dead on arrival. We were, however, able to isolate a local strain of the *marginale* variety, but in my opinion it was too virulent for use in the field. A further consignment of English cattle has enabled other experiments to be conducted on this disease, and recently the Pretoria strain was safely received. Unfortunately it proved fatal to one of our first animals, and I have since heard from Sir Arnold Theiler that what was formerly a mild strain has become exceedingly virulent.

With the general establishment of dipping, this disease, from a point of view of eradication, falls into the same category as East Coast Fever, and it may not be necessary to further continue the Laboratory experiments.

Other bovine diseases which have received attention are Anthrax, Black Quarter, Coccidiosis, Trypanosomiasis, Spirochætosis, the disease due to the Bacillus of Necrosis and the *Bacillus Coli*, and to suspected poisonous plants.

Anthrax and Black Quarter.

Anthrax and Black Quarter (Quarter Evil or Black-leg) have come to our notice more forcibly during the past two years than previously. It is not admitted that this implies extension of the diseases, but that in all probability a more careful examination by the owner, and the submittal of more suitable material for laboratory investigation is responsible for the larger number of cases diagnosed.

Both these diseases are due to germs which may remain in the land for many years, and since they are known to the natives it is possible that the more intensive cropping of the grazing lands is also in some degree to blame for the apparently increased incidence.

An efficient vaccine against Black Quarter is manufactured at the Laboratory, and on infected farms it is recommended that all cattle should be inoculated. In Europe it is commonly held that bovines over two years of age are immune, but in East Africa this does not obtain, and all ages appear susceptible.

Anthrax may also be controlled by inoculation, but as the preparation of the vaccine demands the use of very accurate and delicately adjusted temperatures, we are unable to prepare it until the installation of our gas and electrical plant is completed. A limited amount of vaccine prepared in England is available, and its use would appear to have been followed by satisfactory results.

Colon Bacillosis.

This name may be applied to the disease of stock due to a micro-organism of the group *Bacillus colon*, which investigations of the past two years shew to be fairly common at certain seasons.

The condition, so far as our knowledge at present goes, is chiefly one affecting young and newly-born calves and lambs.

In bovines our experience dates from the middle of 1913, when the same microbe was isolated from a young calf which died from an acute attack of "Scour."

With the microbe so obtained a large number of experiments on lambs and calves have been conducted, and it has been conclusively shewn that this *Bacillus coli* is responsible for at least four types of disease:—

1. Death of lambs or calves within the first three days after birth. Symptoms usually only dullness and inappetence; occasionally some dysentery.

2. Dysentery or ‘ Scour ’ in calves of from one day to two weeks old. The colour of the discharge may vary from white to black.

3. Pneumonia in calves of two to four weeks old, usually unaccompanied by dysentery.

4. An unthriftiness in well-fed calves of one to two months old; this may be the sequel of an earlier disease which has passed unnoticed, or be the immediate result of a more chronic type of infection. Sometimes this is accompanied by a sub-acute or chronic diarrhoea.

NOTE.—This disorder should be carefully disassociated from an indigestion arising from faulty feeding or mismanagement.

The microbe may gain entrance through the mouth and through the unhealed navel cord.

It is realised that medicinal treatment is in very many cases efficacious, but it is felt that should this country ever reach the importance to which it is entitled in the stock-raising industry, and ranching on a large scale take place, that individual dosing and nursing will be a matter of considerable difficulty. Our efforts have therefore been directed towards obtaining a substance which by vaccination at birth may safeguard the young animal through the critical period of its existence. Both sera and vaccines have been prepared, and these are now about to be tried by stock-owners who have kindly volunteered their assistance towards ascertaining the efficacy of these measures. Laboratory experiments indicate that preventive inoculation is possible, but it is essential that field tests on as large a scale as possible be conducted before any conclusion be arrived at.

Necrosis.

The bacillus of Necrosis is an organism very widely spread in nature, and which of itself is possibly not particularly harmful, but when associated with a previous infection of the *Bacillus coli* this microbe gains entrance to small wounds on the tongue and lips, causing thereon extensive ulceration, and it not infrequently finds its way to the liver and there brings about the formation of large bright yellowish areas which are entirely devoid of function. It is hoped that by controlling *Colon Bacillosis* the microbe of Necrosis may be rendered a negligible factor.

Under the heading Poisonous Plants oxen and sheep have received rations containing daily or frequent additions of variable quantities of "Gloriosa Lily," at times a common object in the pastures throughout much of the grazing areas in the Highlands, and of a species of Ragwort (*Senecio* sp.?). These plants had been incriminated by owners as the cause of either sickness or death in their stock, but we were unable to obtain any ill effects from the feeding with the stages of plants experimented upon, although large quantities were consumed and the observations extended over a period of several months.

Trypanosomiasis.

On the subject of Trypanosomiasis may be mentioned some experiments undertaken at the instance of the Entomological Research Committee to ascertain the effect of Rinderpest virus upon tsetse flies. The work originated from a suggestion of Major Stevenson Hamilton, the Game Warden of the Transvaal, who had observed that in the north of that country, although *Glossina* disappeared at the time Rinderpest passed through, there remained, in his opinion, a sufficient number of wild game to provide the blood diet which is held to be necessary for the existence of the tsetse flies.

These experiments are not completed, but it may be stated that there is no immediate mortality among *Glossina palpalis* as a result of feeding upon animals in various stages of Rinderpest; and, further, that though the comparative feeding tests with healthy and diseased blood have been few in number, there is no appreciable difference in the death-rate of the flies used in each series.

The greatest difficulty has been experienced in keeping the flies alive sufficiently long for pupation to take place, as it was felt that possibly only in the second or subsequent generation the effect of diseased virus might be shown.

Contagious Abortion.

It is with regret that I have to chronicle the diagnosis of Contagious (Epizootic) Abortion among cattle in this Protectorate. We have as yet no data to show how long it has been in the country, or whence it was introduced. Prior to suggesting for your consideration any remedial or preventive measures it is most essential that the distribution of this disease throughout the Protectorate be ascertained as accurately as possible, and for this purpose a circular is being prepared which will, I hope, assist in this matter.

DISEASES IN EQUINES.

Epizootic Lymphangitis.

The number of slides received from outside owners which demonstrated the *cryptococcus* of this disease was 15 in 1912-13, and 39 in 1913-14. In 1911-12 the number recorded was 33.

The experimental work into this disease, more especially with regard to treatment, has been continued.

The general principle adopted has been an intravenous injection of Salvarsan ("606"), followed by a course of arsenic in full sub-toxic doses. Two animals, a mule and a donkey, which died of poisoning presented undue susceptibility to this drug. This is a feature we have noted in cattle of this country also, and has an important bearing on the question of dipping.

Owing to the expense of Salvarsan, and the fact that the intravenous injection demands specific technical knowledge and could not be safely carried out by an owner, we are now attempting treatment by more easily administered drugs, but with such a small number of cases available it will be apparent that some years must elapse before any truly satisfactory data can be forthcoming.

We have, however, been enabled to conduct a number of experiments both upon affected and healthy equines, as to the dose of metallic mercury which can be tolerated by the animals in this country. The metal is made into a fine suspension by the addition of fat and oil, and the resultant cream (of a composition similar to that known as Lambkin's) is injected directly into the muscles of the rump.

I was of the opinion that mercury in this form might prove an efficacious remedy, but the data available to us at the present time indicates most forcibly that in doses which may be expected to counteract the *cryptococcus* of this disease it is poisonous to the animal, and I regret therefore that I cannot at this time advocate its use.

The mortality from Epizootic Lymphangitis has in the past exceeded 90 per cent. of the affected equines, and this being the case I would ask all owners of affected animals to place them at our disposal for experimentation.

Ulcerative Lymphangitis.

Fifteen cases of this disease were diagnosed in slides submitted by Veterinary Officers and owners in 1912-13, and 67 in 1913-14, but it is extremely probable that many others were submitted in which a positive diagnosis was not possible. The organism of this disease—the *Bacillus* of Preinz Nocard—is of variable size and shape, one form being highly characteristic, while others on ordinary microscopic examination present no differences from some of the comparatively harmless microbes of a simple abscess.

With this difficulty in diagnosis one of our lines of enquiry has been to obtain an agent similar to Tuberculin and Mallein, which could be employed in clinical practice, but the results at present are not encouraging.

It is to be observed that the course of Ulcerative Lymphangitis in its most typical form is very prolonged, and consequently the organic changes in an affected animal are so great that treatment is an equally prolonged operation. Were it possible to effect a diagnosis early in the disease it is conceivable that remedial measures would be more quickly beneficial.

Experiments as to treatment have been carried out upon all animals made available during the past two years. Owing to our limited stabling accommodation it is to be regretted that it has not been possible to house that number of equines which would with as little delay as possible obtain for us an indication as to the efficacy or otherwise of any particular line of treatment. It may be stated that medicinal treatment by the administration of such drugs as mercury, arsenic and iodine has not yet been shown beneficial. A powerful anti-toxic serum prepared from a horse which had recovered from this disease was also employed experimentally for a period of several months, but the curative action appeared negligible.

By far the best results have been obtained by the weekly injection of a vaccine which we have prepared with the microbes isolated from as many cases of the disease as could be obtained. At the present time we are following a system of weekly injections beneath the skin of the neck with a dose containing 2,000 millions of dead bacteria.

The improvement in very many cases subjected to this treatment has been most remarkable, and I am consequently hopeful that in due course we may be able to issue this vaccine, or a modified product, for general use by the owners of affected equines, but it must be clearly understood that the treatment be prolonged. It is not to be expected that in such a chronic disease a single injection can prove of more than temporary benefit. In severe cases it is probable that twelve or more injections, which at weekly intervals means a duration of more than three months, will be necessary before an owner can observe a definite improvement. The indications of the Laboratory tests being so satisfactory, I propose to ask the co-operation of interested owners on the Uasin Gishu and so put the question to a critical field test.

This disease is frequently complicated by a skin affection which appears to be caused by a different microbe, a streptothrix, and it has continued very prevalent on the Uasin Gishu Plateau, more especially in horses which do not receive proper stable management.

It is known that the *Bacillus* of Preinz Nocard is widely spread in nature, and is probably a constant saprophyte wherever stock is kept. In Europe it is recognised as being one cause of acne in horses, as well as of a chronic disease in sheep characterised by the presence of abscesses in the lymphatic glands and in various organs. These animals may therefore act as carriers of the virus, though without the pre-existence of wounds in horses it at present appears unlikely that entry could be obtained. In the Uasin Gishu there is a prevalent idea that ticks, particularly *Amblyomma variegatum*, are responsible for transmission. I do

not think it likely that they act as vectors of this bacillus, but it is most probable that the organism frequently gains entrance into the wounds left by this tick, the mouth parts of which are very strong and piercing.

The regular dipping of stock will certainly alleviate this complaint, both in virtue of the tick destroying properties and by reason of the antiseptic powers exercised on all sores.

Trypanosomiasis.

Nearly all the forty-eight cases of " Fly-Disease " observed during the two years under review were in animals which had been on safari in the tsetse infected areas which occur in the remoter parts of the Protectorate.

We were able to obtain two of these, a horse and a mule, and treatment on the lines laid down by Holmes in Indian Surra was adopted. The trypanosome in both cases was clearly distinct from *Tr. evansi* of Surra, and this may account for our failure to obtain any indication of success by this method.

As was suggested when discussing the treatment of Epizootic Lymphangitis, animals in this country appear very susceptible to arsenic. It is for this reason that comparative experiments have been instituted with a view to ascertaining the correct dosage for use here, and in the meantime we are endeavouring to obtain favourable indications by the employment of mercury in place of arsenic.

The species of *Trypanosomata* obtainable in East Africa are many, and the services of two or three men might well be devoted to their study, both for means of identification and to ascertain clearly and finally by what means they are spread.

I cannot disguise the fear that under the altering conditions of these Highlands we may one day be faced by some slight trouble from members of this group of parasites, and for this reason it is inadvisable to entirely dissociate ourselves from this disease, unimportant though it is at the present time.

Horse Sickness.

As mentioned in previous reports, we are unable to conduct any satisfactory experiments on this disease here, partly owing to the impossibility of obtaining a sufficient number of suitable horses for any reliance to be placed on our results, and also on the ground that up to now many animals experimented upon have proved immune.

In the interests of both this Protectorate and of South Africa, Sir Arnild Theiler has kindly undertaken to test the virulence of our strains in the hope of obtaining a mild type which may confer immunity to other and more virulent forms of the disease.

It is interesting to note that approximately one-half of the total number of blood specimens collected from what must be regarded as typical clinical cases of this disease were proved not to contain the virus of Horse Sickness. This is a clear demonstration of the hypothesis previously advanced that in this country there exists a disease resembling Horse Sickness which is not due to that virus, and which may therefore be combated on more simple and economical lines than is possible in the case of the older known disease.

I would therefore again make an appeal to all horse owners to assist in this investigation. A large majority of equines die before the services of a Veterinary Officer can be obtained, and it is from these animals in particular that we desire all available information and material.

Preservative solutions and full directions as to the collection of necessary data and specimens will be forwarded to any owner who is good enough to apply.

Anæmia.

Opportunity was afforded during the year of commencing an investigation into the disease referred to in last year's report as Infectious Anæmia.

I first observed such a condition on the Fort Hall Road in 1909, when a number of donkeys were seen presenting the clinical picture of trypanosomiasis. They were extremely emaciated, the mucous membrane of the eye and mouth very pale and anæmic looking, and under the abdomen or chest were large dropsical swellings. No micro-organism or parasite could be detected in the blood.

In August, 1912, we received six donkeys belonging to a Government Department which manifested all symptoms of the disease in question, but neither by cohabitation, inoculation or other means were we able to bring about any disturbance in healthy donkeys drawn directly from a clean native area, or in any other animals experimented upon. It would appear, therefore, that the condition observed is not the Infectious Anæmia of the French and American writers, a disease which is inoculable and due to an invisible microbe, and which has recently been diagnosed in South Africa.

Examination of the dung of the affected animals showed the presence of a small round worm (*S. tetracanthus*) in large numbers, and there is some reason to believe that this may have been the cause. Further investigation in various affected herds will require to be made in order to elucidate this point.

DISEASES OF SHEEP.

Wireworm.

A very large number of experiments have been carried out with a view to obtaining a safe and efficient dose against the wireworm *Hæmonchus* (*Strongylus*) *contortus*, a common parasite in the fourth stomach of sheep and goats.

It is highly probable that few animals escape infection, and there are many which, though harbouring the worm, manifest no symptoms, yet are capable of maintaining the infection on the pastures.

The life cycle of the *Hæmonchus* has not yet been fully studied in this country, but we have obtained a certain amount of data which indicates that it is closely comparable with that worked out by Ransom in the United States.

Affected animals pass large numbers of eggs in their dung, these being laid by the female worms which are confined to the fourth stomach, and do not occur in any other part of the alimentary tract. Within a few days these ova hatch to give rise to minute but active embryos, which are rather susceptible to heat and cold, and apparently are incapable of infecting new sheep. In about a fortnight the appearance of these little embryos is quite changed, all signs of mouth and pharynx have disappeared, and the body is surrounded by a new cuticle which renders this form highly resistant to heat, cold and dryness.

This form, which is now capable of infecting new sheep, possesses a curious faculty of climbing up grass whenever this is moist with rain or dew, and so reaching a position where it is more likely to be taken in with the food.

When this encysted form has arrived in the stomach, it appears that about three weeks is necessary for it to develop into an adult worm capable of reproduction. How long this form can live under the influence of the East African sun is not yet known, but we have in the Laboratory living examples which have remained in a sealed tube for over twelve months. In America it is considered that about fifteen months is necessary to bring about death by starvation. It is possible that this period may be shortened for many parts of this Protectorate.

These points are important, since it will be apparent to the reader that by systematic treatment and an ordained method of de-stocking for the period necessary to ensure starvation of the embryo worms, it would be possible to raise a clean crop of lambs, and from them eventually a flock of animals non-parasitised by this worm.

For the purpose of this investigation a series of small paddocks have been made at the Laboratory, and they are now being cleaned by the starvation process prior to commencing infection experiments.

In our efforts to obtain an efficient drench against this parasite we have considered that the ideal remedy should possess the following characteristics:—

1. Efficacy.
2. Non-poisonousness.
4. Fluid.
4. Cheapness.

It should be efficacious and non-poisonous in such extra doses as are always liable to be given when the dosing is left to the native herd-boy. It may be a moot point whether a powder or a liquid dose is preferable, but the majority of sheep-men whom I have consulted elected in favour of the latter.

It is of course desirable that the amount required should not be too bulky, and I would consider one ounce (two table-spoonsful) as a convenient quantity to administer. In practice it would be advisable to obtain from a tinsmith a number of small tin tubes with rounded lip, holding the exact dose, although many owners prefer to administer the drench by means of a glass syringe.

There is a point in the administration of medicines to ruminants when it is desired to ensure prompt action on the fourth stomach that is often neglected by stock-owners. It has been found experimentally that if an animal is made to sit on its haunches and the nose held up in the air, the majority of the fluid administered passes into the first stomach (paunch or rumen), from which it only filters slowly into the fourth stomach, wherein live the wire-worms. By standing the sheep squarely on all four legs, and not elevating the nose above the line formed when the head is horizontal to the ground, it has been shewn that the majority of the drench passes directly into the fourth stomach, thereby attacking the parasites at once, and in its concentrated form.

As a result of our observations up to the present we have come to the conclusion that a proprietary disinfectant called "Lysol" is beneficial in this complaint, and I consider that we have conducted a sufficiently large number of experiments to demonstrate the superiority of this preparation over the commonly used Bluestone, Arsenic, and Cooper's Dip, and it has the additional advantage of being non-poisonous even in such extreme doses that not even a native could unintentionally give.

The fluid costs about ten shillings and sixpence per gallon in Europe; it mixes readily in any class of water, and once mixed there is no separation and no dangerous sediment.

At the present I advocate the use of a mixture composed of one part Lysol to nineteen parts of water (*i.e.*, a 5 per cent. solution), the dose of which is one ounce. Three thousand, two hundred doses may therefore be obtained from one gallon of Lysol.

The non-toxicity of this solution is demonstrated by the following experiments:—

1. Five times the above dose has been given without any ill effect.

2. The dose of one ounce of a 5 per cent. solution has been administered to eight sheep daily for ten days without any disturbance of health.

3. Sheep have received this treatment one day before, on the same day, and one day after dipping in the usual arsenical dips without any ill effect.

4. Sheep while receiving a daily dose of Lysol have had free access to a lick composed of:—

Salt	...	...	...	30 parts.
Lime	...	...	...	2 parts.
Sulphate of Iron	...	...	...	1 part.

All sheep-owners are agreed that these results could not have been obtained had arsenical preparation in full doses been employed in the place of Lysol.

In regard to efficacy I may say that our experiments were carried out upon sheep which were most heavily infested with *Hæmonchus contortus*, and that under treatment these have steadily improved in condition and weight as opposed to the gradual wasting and often death in untreated animals kept as controls.

Further experiments in connection with this disease are in progress, but I believe our results to be of sufficient value and importance to warrant this preliminary publication.

In conclusion I may add that only such diseases as appeared to me to possess considerable interest to the stock-owner have been dealt with in this report. There have been a considerable number of others, which are as yet, fortunately, of minor importance, under experiment. I consider it our duty so far as possible to undertake the preliminary investigation of all diseases which come within our knowledge, and by so doing to be in some measure prepared for eventualities.

I have the honour to be, Sir,

Your obedient servant,

R. E. MONTGOMERY,

Veterinary Pathologist.
